UNITED STATES ARMY
SIGNAL SCHOOL
FORT GORDON, GEORGIA

DIAGRAM

LOW POWER AMPLIFIER AN/TSC-54

102-F6/A30-A32-D(5) APPROVED: 18 SEP 78

S/S 102-F6/A30-A32-15

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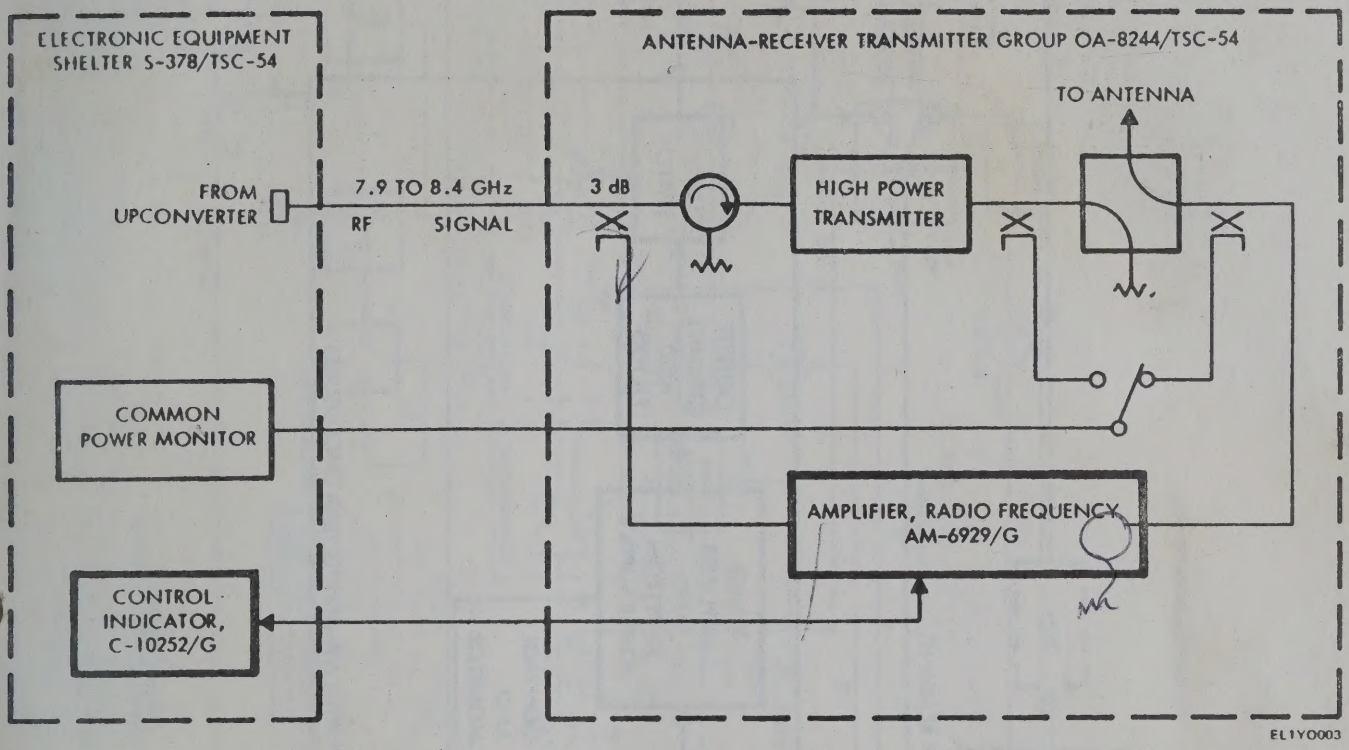
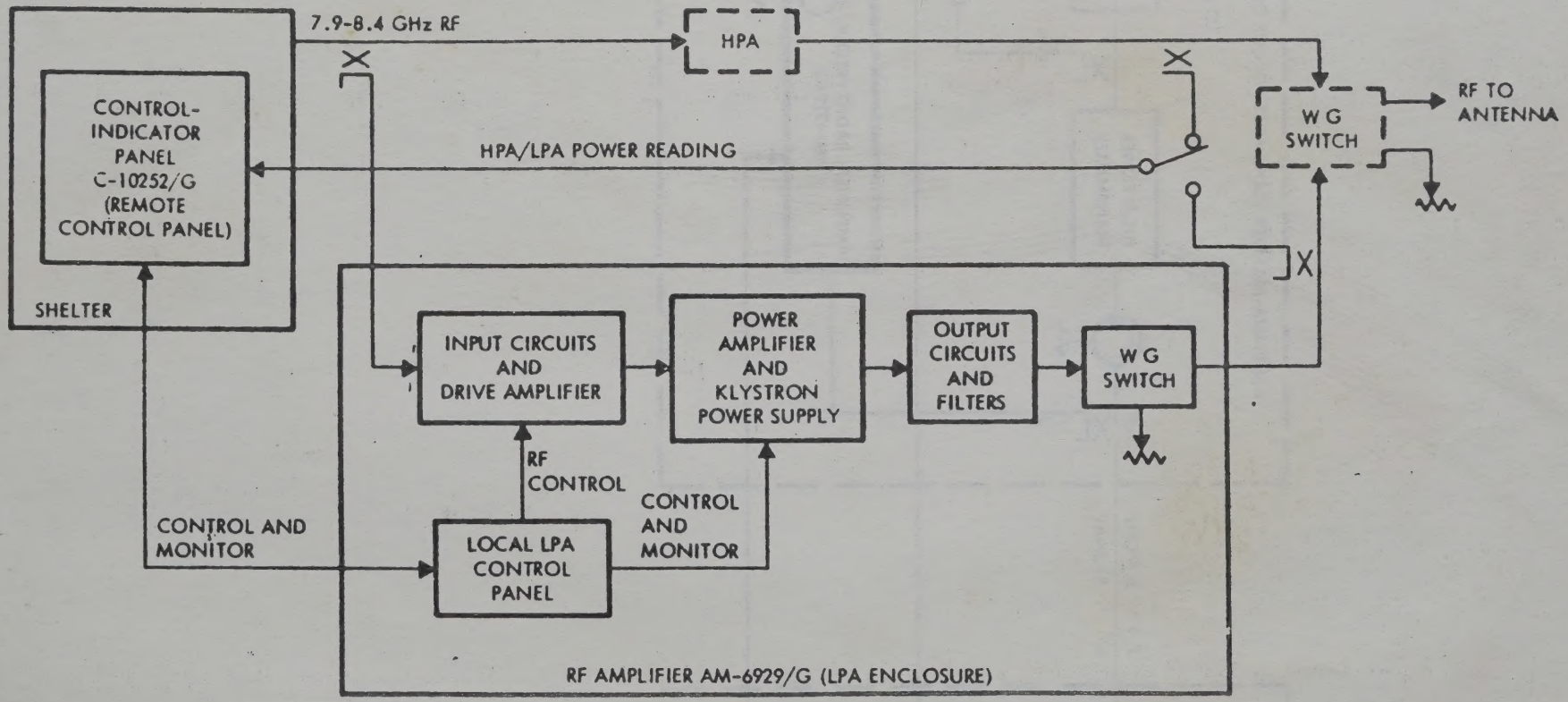
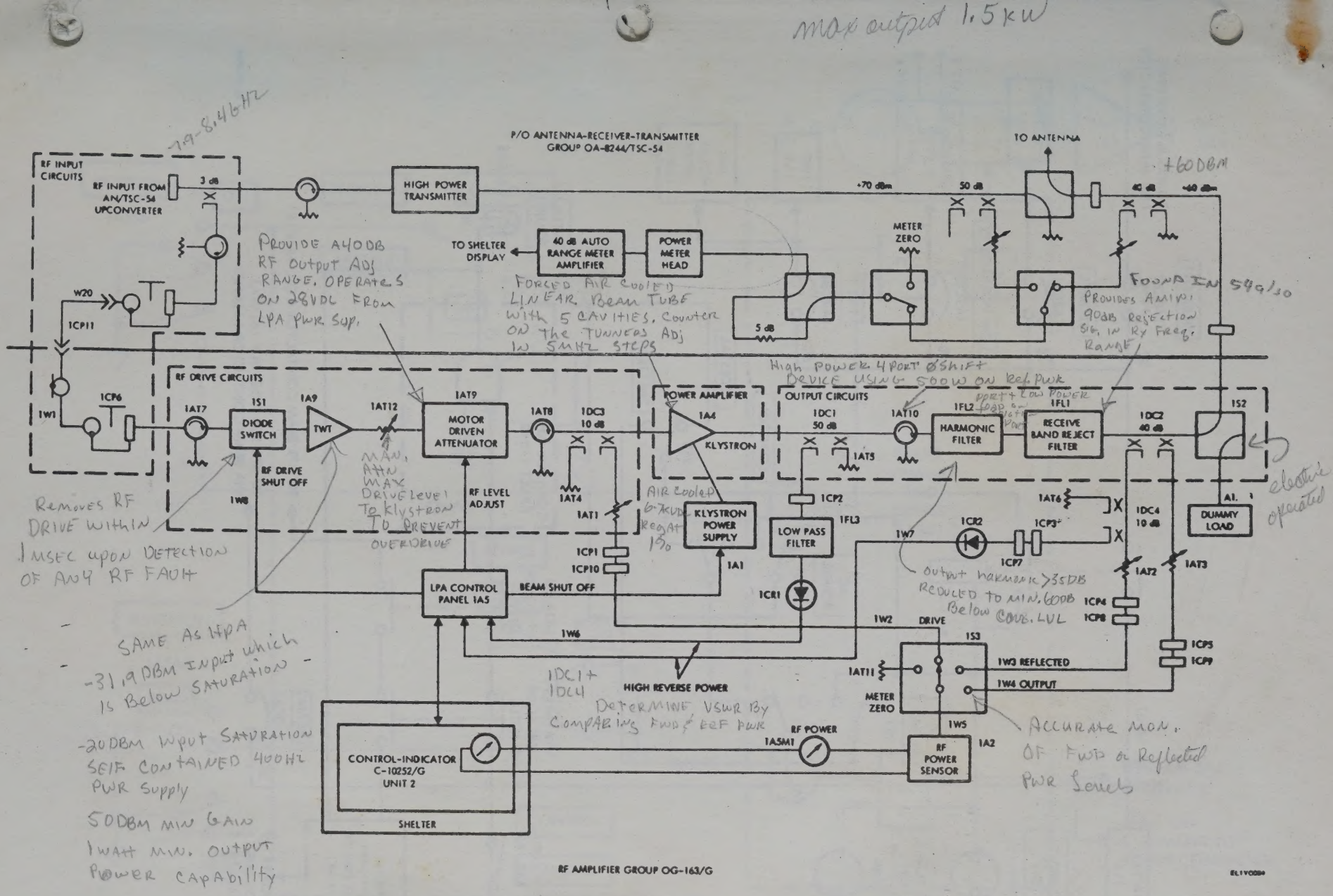
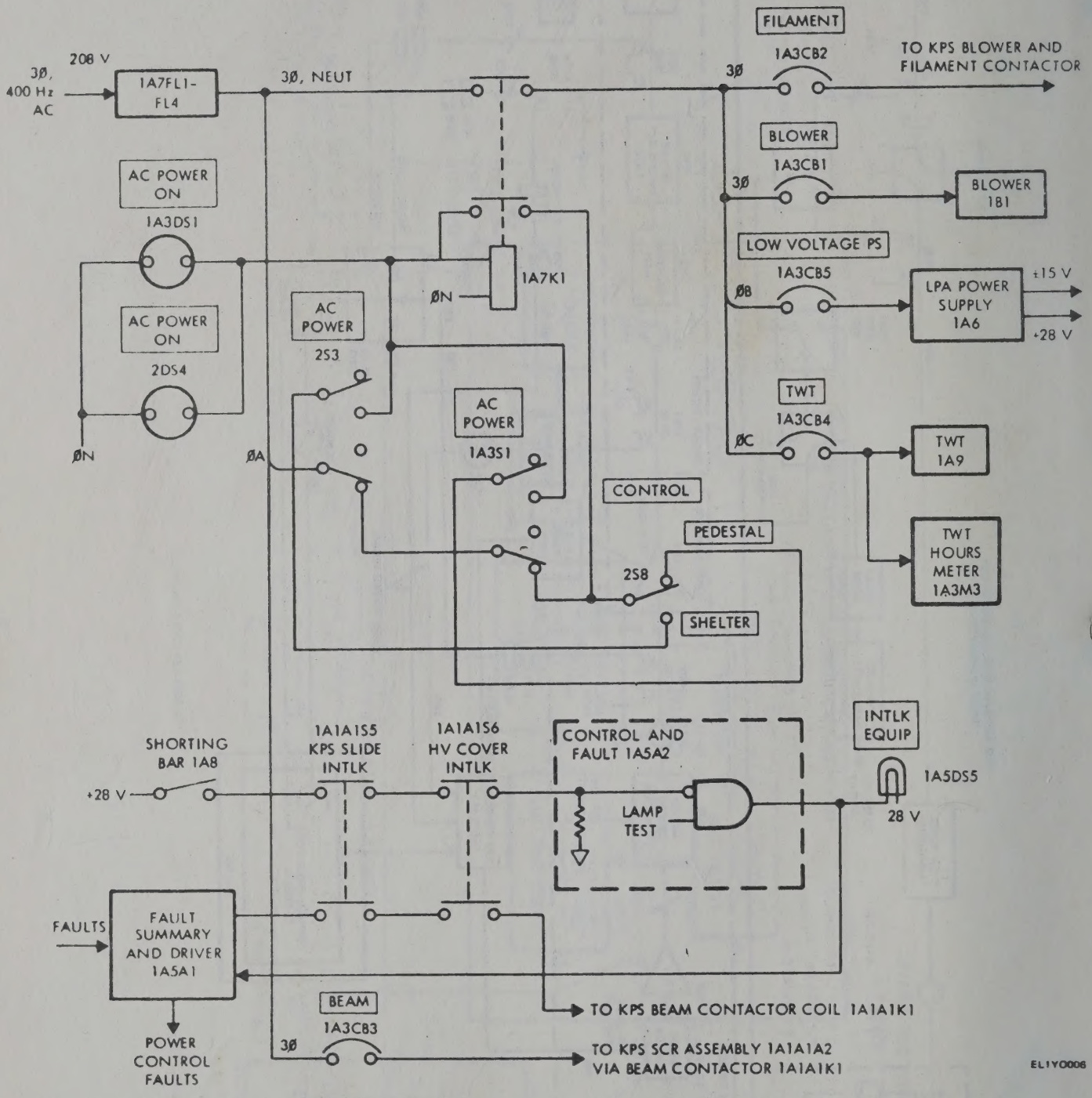

ELECTRONIC EQUIPMENT
SHELTER S-378/TSC-54
ANTENNA-RECEIVER TRANSMITTER GROUP OA-8244/TSC-54
TO ANTENNA
FROM
UPCONVERTER
7.9 TO 8.4 GHz
RF SIGNAL
3 dB
HIGH POWER
TRANSMITTER
COMMON
POWER MONITOR
AMPLIFIER, RADIO FREQUENCY
AM-6929/G
CONTROL
INDICATOR,
C-10252/G
EL1YO003

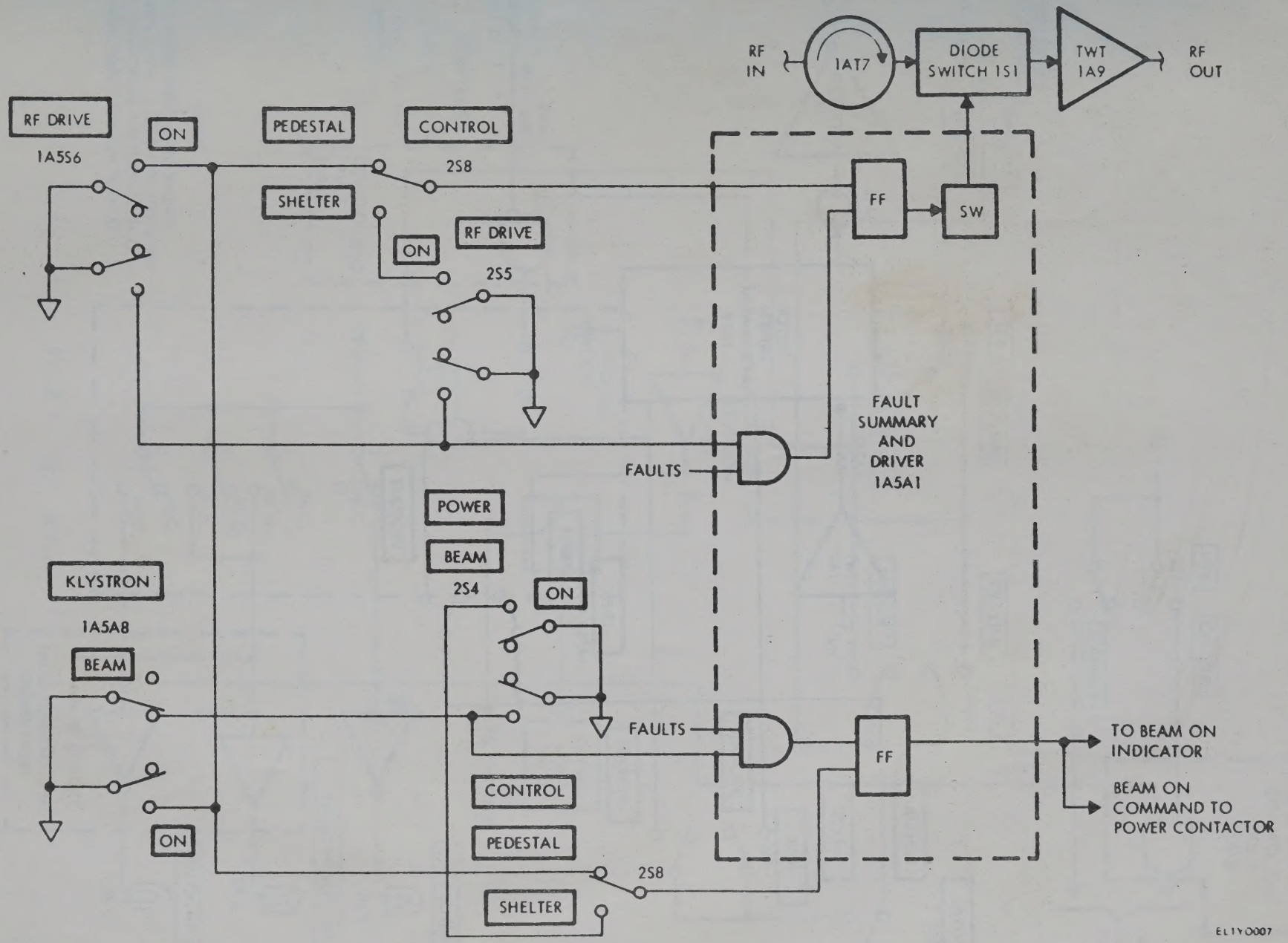


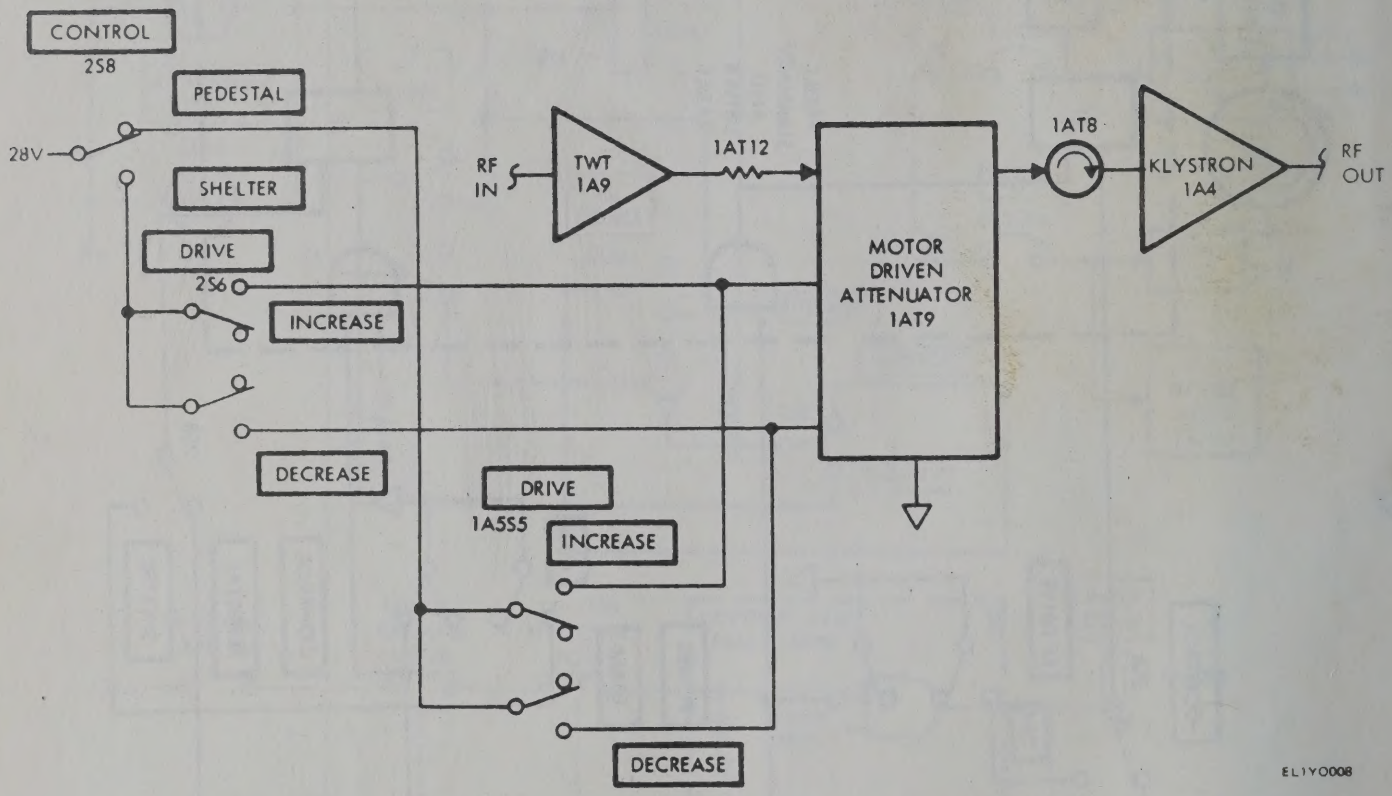
NOTE: DASHED LINES (---) INDICATE
EXISTING TERMINAL EQUIPMENT.

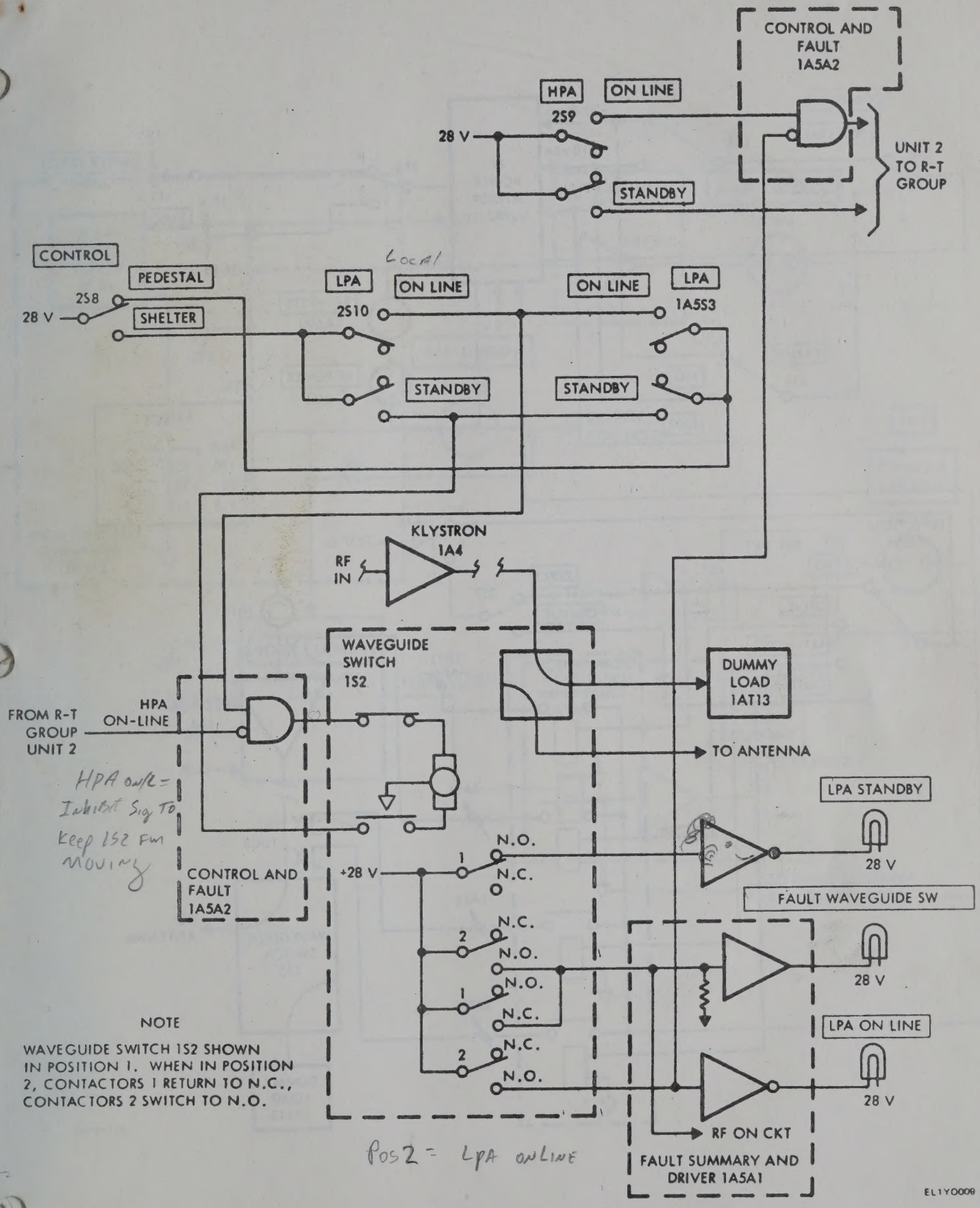
EL1YN004

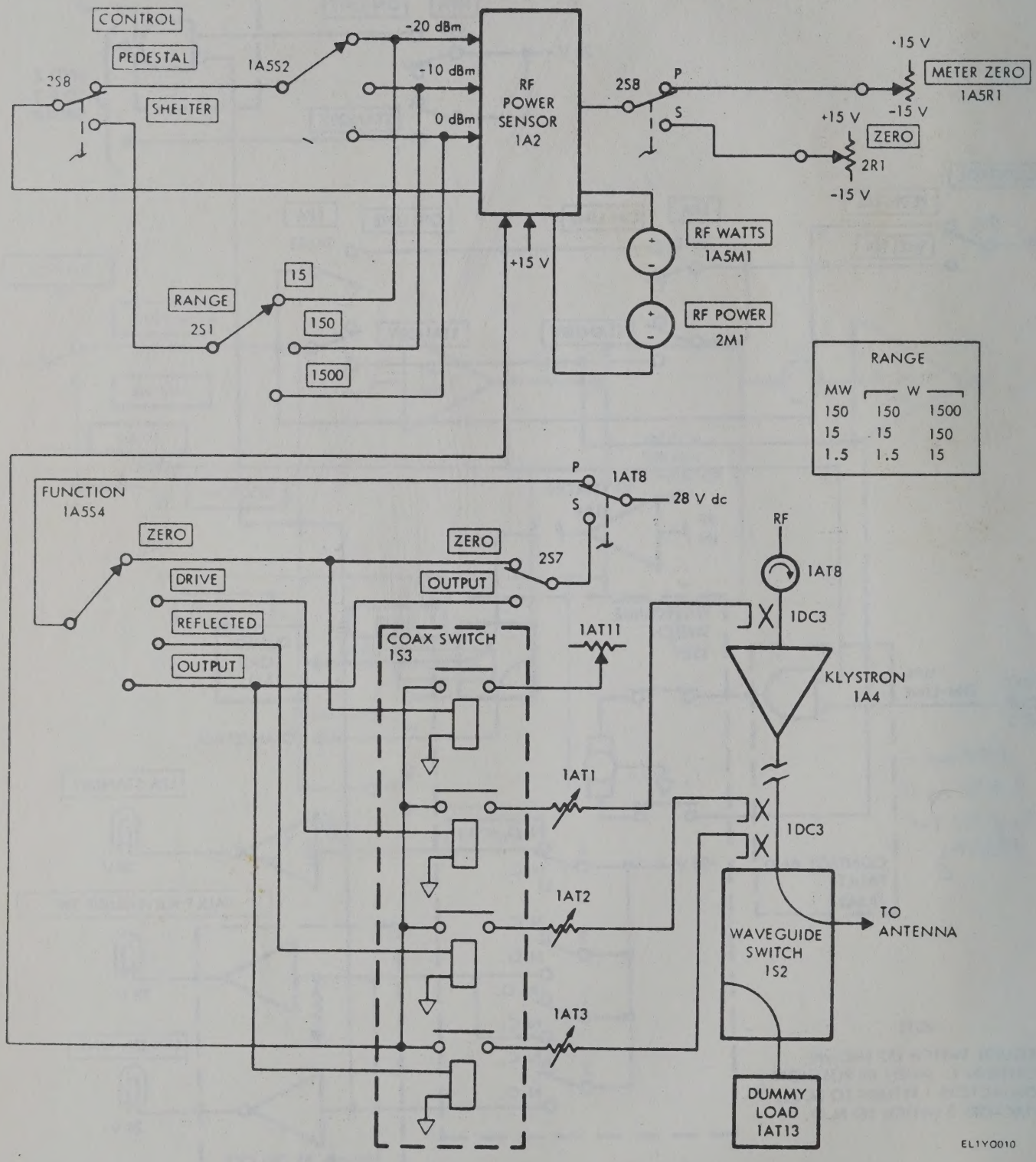

max output 1.5kW
7.9-8.46MHz
P/O ANTENNA-RECEIVER-TRANSMITTER GROUP OA-8244/TSC-54
TO ANTENNA
+60DBM
RF INPUT CIRCUITS
RF INPUT FROM AN/TSC-54 UPCONVERTER
3 dB
HIGH POWER TRANSMITTER
+70 dBm
50 dB
40 dB
+40 dBm
PROVIDE A40DB RF OUTPUT ADJ RANGE. OPERATES ON 28VDC FROM LPA PWR SUP.
TO SHELTER DISPLAY
40 dB AUTO RANGE METER AMPLIFIER
POWER METER HEAD
FORCED AIR COOLED LINEAR BEAM TUBE WITH 5 CAVITIES, COUNTER ON THE TUNNERS ADJ IN 5MHZ STEPS
METER ZERO
5 dB
FOUND IN 540/50
PROVIDES AMIN. 90DB REJECTION SIG. IN RX FREQ. RANGE
W20
1CP11
1W1
1CP6
RF DRIVE CIRCUITS
1AT7
1S1
DIODE SWITCH
1A9
TWT
1AT12
1AT9
MOTOR DRIVEN ATTENUATOR
1AT8
1DC3
10 dB
POWER AMPLIFIER
1A4
KLYSTRON
High POWER 4 PORT ØSHIFT DEVICE USING 500W ON Ref. PWR
OUTPUT CIRCUITS
1DC1
50 dB
1AT10
1FL2
1FL1
HARMONIC FILTER
RECEIVE BAND REJECT FILTER
1DC2
40 dB
1S2
1AT5
RF DRIVE SHUT OFF
1W8
MAN. ATTN MAX DRIVE LEVEL TO klystron TO PREVENT OVERDRIVE
RF LEVEL ADJUST
1AT4
1AT1
AIR Cooled 6-7KVA Regat 1%
KLYSTRON POWER SUPPLY
1A1
1CP2
LOW PASS FILTER
1FL3
1CR1
1CP1
1CP10
1W7
1CR2
1CP7
1AT6
1DC4
10 dB
A1. 1
DUMMY LOAD
1AT2
1AT3
1CP4
1CP8
1CP5
1CP9
Removes RF DRIVE WITHIN .1MSEC UPON DETECTION OF ANY RF FAULT
LPA CONTROL PANEL 1A5
BEAM SHUT OFF
1W6
1W2
DRIVE
1S3
1W3 REFLECTED
1W4 OUTPUT
1AT11
METER ZERO
1W5
1DC1 + 1DC4
HIGH REVERSE POWER
DETERMINE VSWR BY COMPARING FWD & REF PWR
RF POWER 1ASM1
1A2
RF POWER SENSOR
ACCURATE MON. OF FWD or Reflected PWR Levels
CONTROL-INDICATOR C-10252/G UNIT 2
SHELTER
SAME AS HPA
-31.9DBM INPUT which IS Below SATURATION
-20DBM Input SATURATION
SELF CONTAINED 400HZ PWR Supply
50DBM MIN GAIN
1WATT MIN. OUTPUT POWER CAPABILITY
RF AMPLIFIER GROUP OG-163/G
output HARMONIC >35DB REDUCED TO MIN. 60DB Below COMB. LVL
electrically operated
LPA
REF p.18

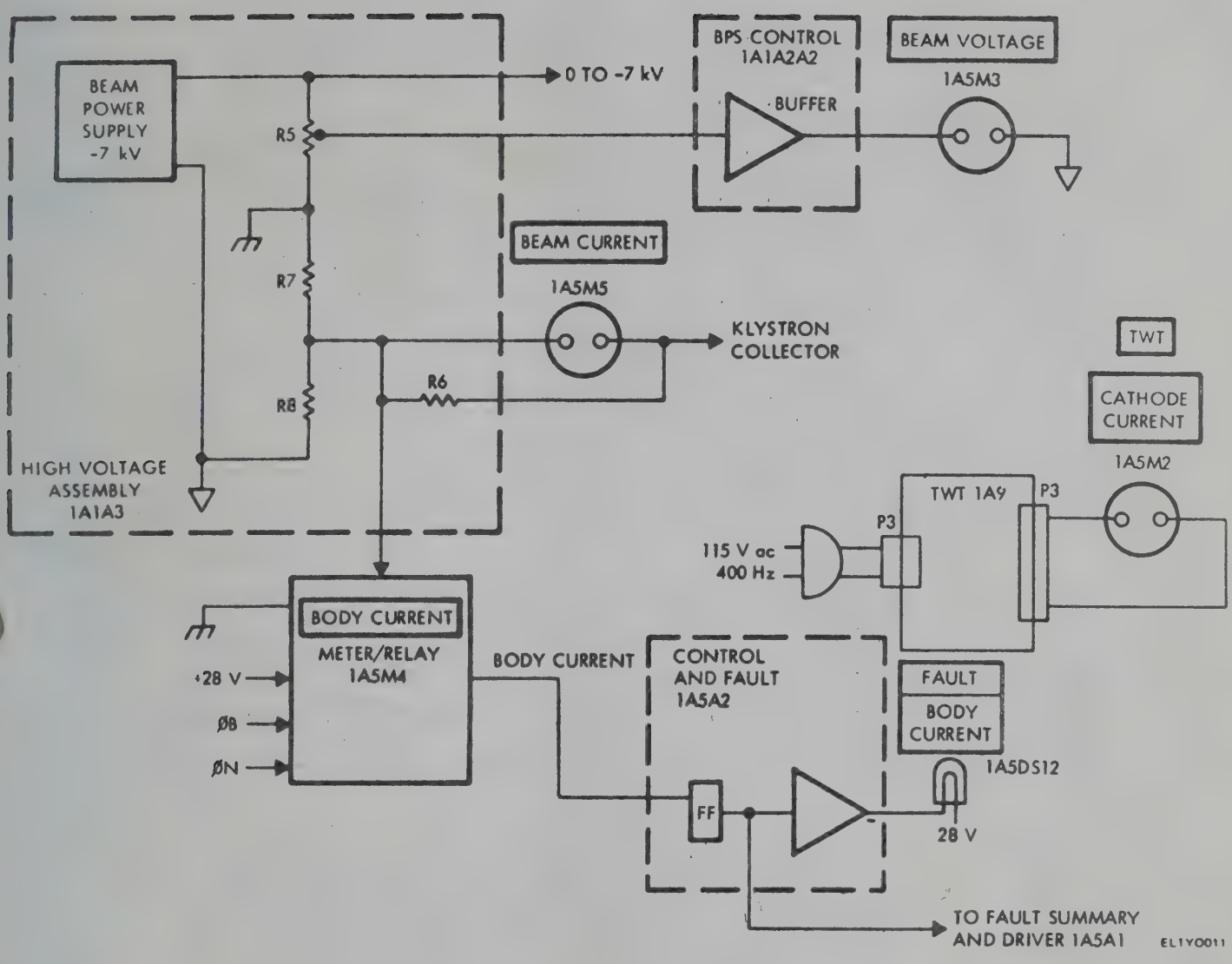

208 V
3Ø, 400 Hz AC
1A7FL1-FL4
3Ø, NEUT
FILAMENT
1A3CB2
3Ø
TO KPS BLOWER AND FILAMENT CONTACTOR
BLOWER
1A3CB1
3Ø
BLOWER 1B1
AC POWER ON
1A3DS1
AC POWER ON
2DS4
ØN
1A7K1
ØN
AC POWER
2S3
AC POWER
1A3S1
ØA
LOW VOLTAGE PS
1A3CB5
ØB
LPA POWER SUPPLY 1A6
±15 V
+28 V
TWT
1A3CB4
ØC
TWT 1A9
TWT HOURS METER 1A3M3
CONTROL
PEDESTAL
2S8
SHELTER
SHORTING BAR 1A8
+28 V
1A1A1S5 KPS SLIDE INTLK
1A1A1S6 HV COVER INTLK
CONTROL AND FAULT 1A5A2
LAMP TEST
INTLK EQUIP
1A5DS5
28 V
FAULTS
FAULT SUMMARY AND DRIVER 1A5A1
BEAM
1A3CB3
3Ø
POWER CONTROL FAULTS
TO KPS BEAM CONTACTOR COIL 1A1A1K1
TO KPS SCR ASSEMBLY 1A1A1A2 VIA BEAM CONTACTOR 1A1A1K1
EL1Y0006

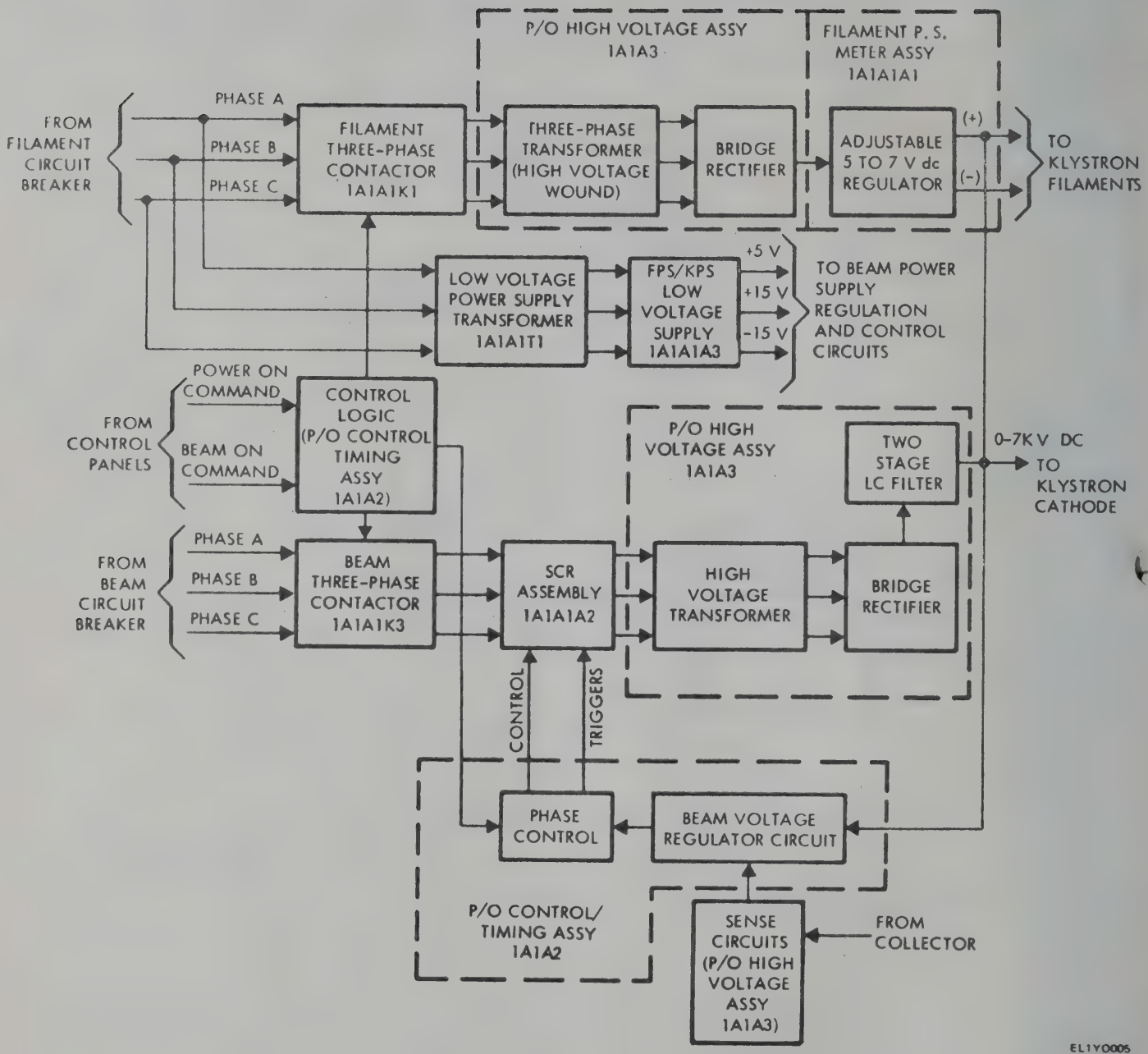

RF IN
1AT7
DIODE SWITCH 1S1
TWT 1A9
RF OUT
RF DRIVE
1A5S6
ON
PEDESTAL
CONTROL
2S8
SHELTER
ON
RF DRIVE
2S5
FF
SW
FAULT SUMMARY AND DRIVER 1A5A1
FAULTS
POWER
BEAM
2S4
ON
KLYSTRON
1A5A8
BEAM
FAULTS
FF
TO BEAM ON INDICATOR
BEAM ON COMMAND TO POWER CONTACTOR
CONTROL
PEDESTAL
2S8
ON
SHELTER
EL1Y0007

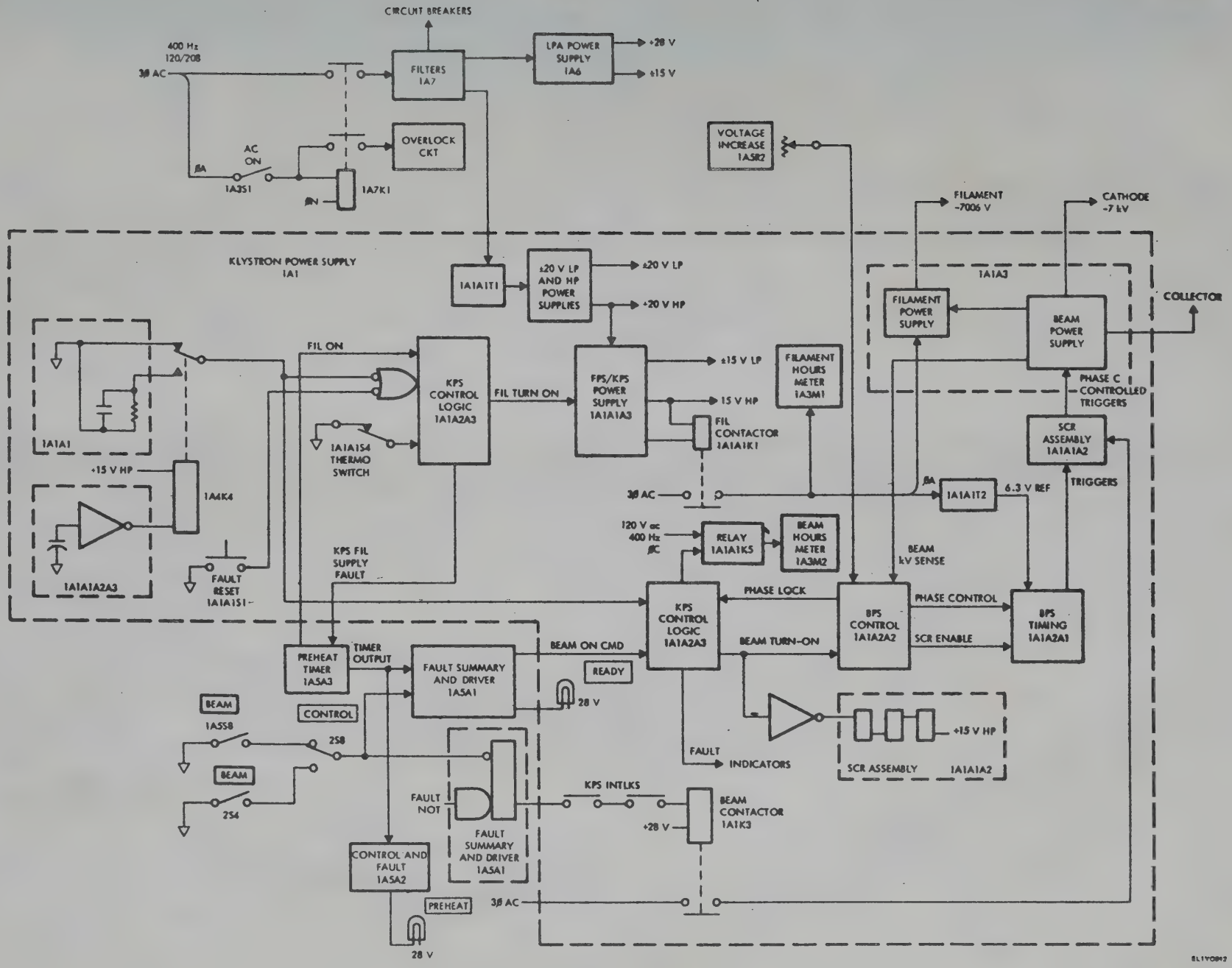

CONTROL
2S8
PEDESTAL
28V
SHELTER
DRIVE
2S6
INCREASE
DECREASE
DRIVE
1A5S5
INCREASE
DECREASE
RF
IN
TWT
1A9
1AT12
MOTOR
DRIVEN
ATTENUATOR
1AT9
1AT8
KLYSTRON
1A4
RF
OUT
EL1Y0008

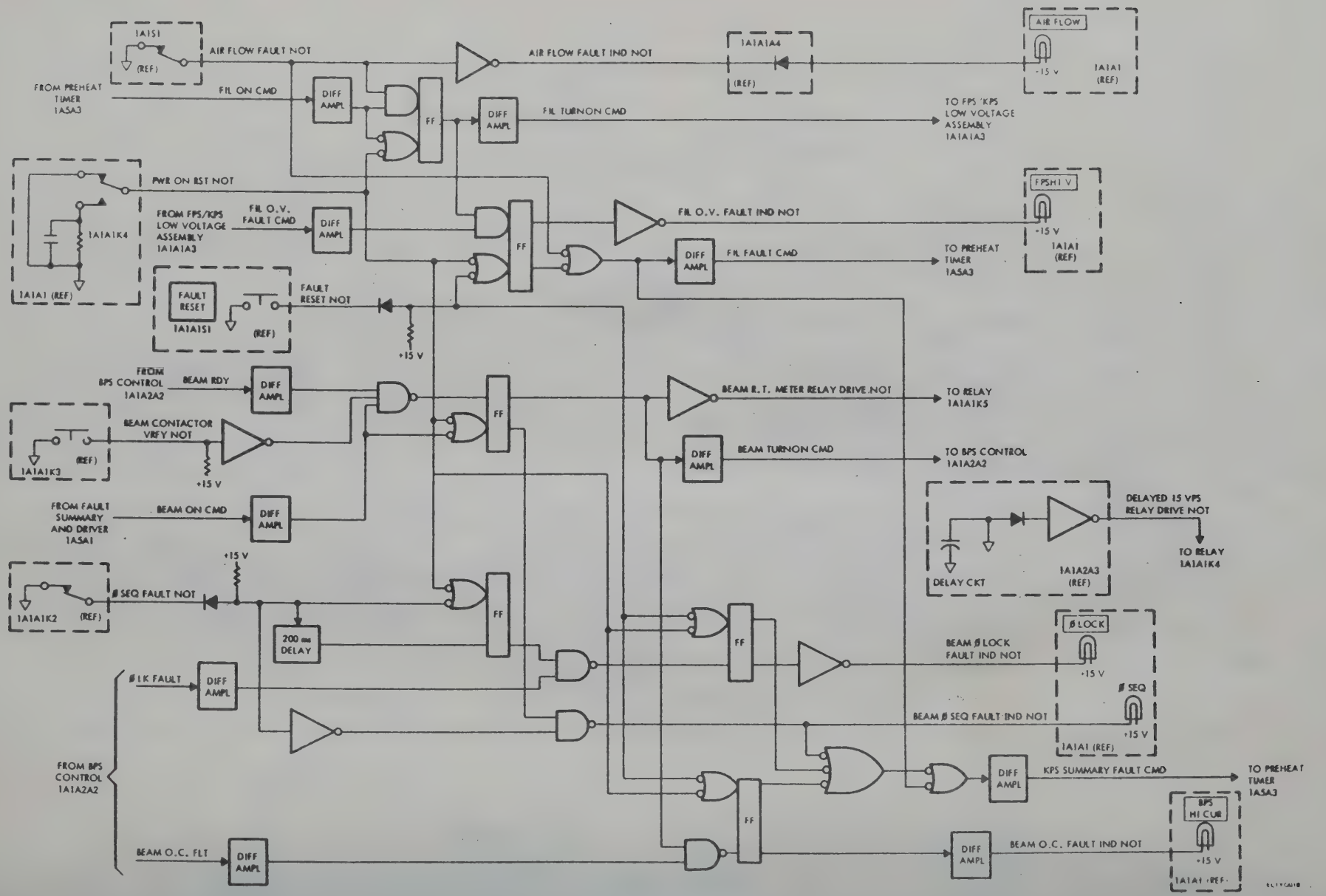

CONTROL AND FAULT 1A5A2
HPA
2S9
ON LINE
28 V
STANDBY
UNIT 2 TO R-T GROUP
CONTROL
PEDESTAL
2S8
28 V
SHELTER
Local
LPA
ON LINE
2S10
ON LINE
LPA
1A5S3
STANDBY
STANDBY
KLYSTRON
1A4
RF IN
WAVEGUIDE SWITCH 1S2
DUMMY LOAD 1AT13
FROM R-T GROUP UNIT 2
HPA ON-LINE
TO ANTENNA
HPA on/L = Inhibit Sig To Keep 1S2 From Moving
LPA STANDBY
28 V
N.O.
N.C.
+28 V
CONTROL AND FAULT 1A5A2
FAULT WAVEGUIDE SW
28 V
LPA ON LINE
28 V
RF ON CKT
FAULT SUMMARY AND DRIVER 1A5A1
NOTE
WAVEGUIDE SWITCH 1S2 SHOWN IN POSITION 1. WHEN IN POSITION 2, CONTACTORS 1 RETURN TO N.C., CONTACTORS 2 SWITCH TO N.O.
Pos 2 = LPA on Line
EL1Y0009

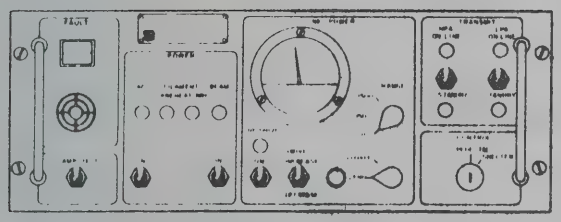

CONTROL
PEDESTAL
2S8
SHELTER
1A5S2
-20 dBm
-10 dBm
0 dBm
RF POWER SENSOR 1A2
+15 V
2S8
P
S
METER ZERO
1A5R1
+15 V
-15 V
ZERO
2R1
-15 V
RF WATTS
1A5M1
RF POWER
2M1
+15 V
RANGE
2S1
15
150
1500
RANGE
MW
W
150
150
1500
15
15
150
1.5
1.5
15
FUNCTION
1A5S4
P
1AT8
S
28 V dc
ZERO
ZERO
2S7
DRIVE
OUTPUT
REFLECTED
OUTPUT
COAX SWITCH
1S3
1AT11
RF
1AT8
1DC3
KLYSTRON
1A4
1AT1
1DC3
1AT2
TO
ANTENNA
WAVEGUIDE
SWITCH
1S2
1AT3
DUMMY
LOAD
1AT13
EL1YO010


BEAM POWER SUPPLY -7 kV
0 TO -7 kV
BPS CONTROL 1A1A2A2
BUFFER
BEAM VOLTAGE
1A5M3
R5
R7
R8
R6
BEAM CURRENT
1A5M5
KLYSTRON COLLECTOR
TWT
CATHODE CURRENT
1A5M2
HIGH VOLTAGE ASSEMBLY 1A1A3
TWT 1A9
P3
P3
115 V ac 400 Hz
BODY CURRENT
METER/RELAY 1A5M4
+28 V
ØB
ØN
BODY CURRENT
CONTROL AND FAULT 1A5A2
FAULT
BODY CURRENT
1A5DS12
FF
28 V
TO FAULT SUMMARY AND DRIVER 1A5A1
EL1Y0011

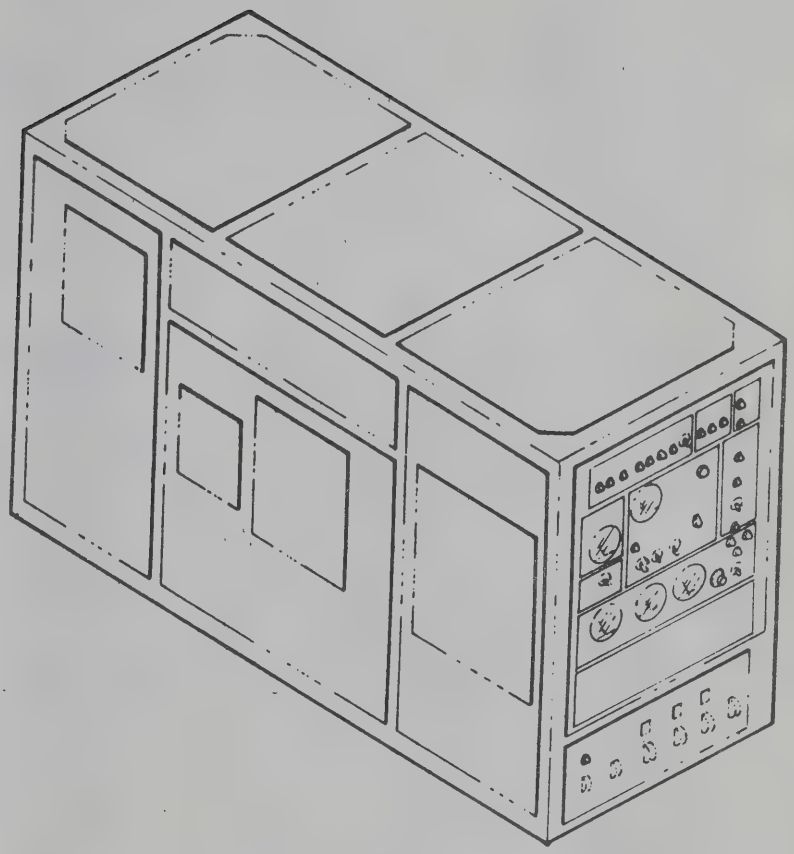

P/O HIGH VOLTAGE ASSY
1A1A3
FILAMENT P. S.
METER ASSY
1A1A1A1
FROM
FILAMENT
CIRCUIT
BREAKER
PHASE A
PHASE B
PHASE C
FILAMENT
THREE-PHASE
CONTACTOR
1A1A1K1
THREE-PHASE
TRANSFORMER
(HIGH VOLTAGE
WOUND)
BRIDGE
RECTIFIER
ADJUSTABLE
5 TO 7 V dc
REGULATOR
(+)
(-)
TO
KLYSTRON
FILAMENTS
LOW VOLTAGE
POWER SUPPLY
TRANSFORMER
1A1A1T1
FPS/KPS
LOW
VOLTAGE
SUPPLY
1A1A1A3
+5 V
+15 V
-15 V
TO BEAM POWER
SUPPLY
REGULATION
AND CONTROL
CIRCUITS
POWER ON
COMMAND
BEAM ON
COMMAND
FROM
CONTROL
PANELS
CONTROL
LOGIC
(P/O CONTROL
TIMING
ASSY
1A1A2)
P/O HIGH
VOLTAGE ASSY
1A1A3
TWO
STAGE
LC FILTER
0-7KV DC
TO
KLYSTRON
CATHODE
FROM
BEAM
CIRCUIT
BREAKER
PHASE A
PHASE B
PHASE C
BEAM
THREE-PHASE
CONTACTOR
1A1A1K3
SCR
ASSEMBLY
1A1A1A2
HIGH
VOLTAGE
TRANSFORMER
BRIDGE
RECTIFIER
CONTROL
TRIGGERS
PHASE
CONTROL
BEAM VOLTAGE
REGULATOR CIRCUIT
P/O CONTROL/
TIMING ASSY
1A1A2
SENSE
CIRCUITS
(P/O HIGH
VOLTAGE
ASSY
1A1A3)
FROM
COLLECTOR
EL1Y0005


CIRCUIT BREAKERS
400 Hz 120/208 3Ø AC
FILTERS 1A7
LPA POWER SUPPLY 1A6
+28 V
±15 V
OVERLOCK CKT
AC ON
ØA
1A3S1
ØN
1A7K1
VOLTAGE INCREASE 1A5R2
FILAMENT -7006 V
CATHODE -7 kV
KLYSTRON POWER SUPPLY 1A1
1A1A1T1
±20 V LP AND HP POWER SUPPLIES
±20 V LP
+20 V HP
1A1A3
FILAMENT POWER SUPPLY
BEAM POWER SUPPLY
COLLECTOR
PHASE C CONTROLLED TRIGGERS
SCR ASSEMBLY 1A1A1A2
TRIGGERS
FIL ON
KPS CONTROL LOGIC 1A1A2A3
FIL TURN ON
FPS/KPS POWER SUPPLY 1A1A1A3
±15 V LP
15 V HP
FIL CONTACTOR 1A1A1K1
FILAMENT HOURS METER 1A3M1
1A1A1S4 THERMO SWITCH
1A1A1
+15 V HP
1A4K4
1A1A1A2A3
FAULT RESET 1A1A1S1
KPS FIL SUPPLY FAULT
3Ø AC
1A1A1T2
6.3 V REF
120 V ac 400 Hz ØC
RELAY 1A1A1K5
BEAM HOURS METER 1A3M2
BEAM kV SENSE
KPS CONTROL LOGIC 1A1A2A3
PHASE LOCK
BPS CONTROL 1A1A2A2
PHASE CONTROL
SCR ENABLE
BPS TIMING 1A1A2A1
PREHEAT TIMER 1A5A3
TIMER OUTPUT
FAULT SUMMARY AND DRIVER 1A5A1
BEAM ON CMD
READY
28 V
BEAM 1A5S8
CONTROL
2S8
BEAM
2S4
FAULT INDICATORS
+15 V HP
SCR ASSEMBLY 1A1A1A2
FAULT NOT
KPS INTLKS
BEAM CONTACTOR 1A1K3
+28 V
FAULT SUMMARY AND DRIVER 1A5A1
CONTROL AND FAULT 1A5A2
PREHEAT
3Ø AC
28 V


1A1S1
(REF)
AIR FLOW FAULT NOT
FROM PREHEAT TIMER 1ASA3
FIL ON CMD
DIFF AMPL
FF
AIR FLOW FAULT IND NOT
1A1A1A4
(REF)
AIR FLOW
+15 V
1A1A1 (REF)
DIFF AMPL
FIL TURNON CMD
TO FPS 'KPS LOW VOLTAGE ASSEMBLY 1A1A1A3
PWR ON RST NOT
1A1A1K4
1A1A1 (REF)
FROM FPS/KPS LOW VOLTAGE ASSEMBLY 1A1A1A3
FIL O.V. FAULT CMD
DIFF AMPL
FIL O.V. FAULT IND NOT
FPSH1 V
+15 V
1A1A1 (REF)
DIFF AMPL
FIL FAULT CMD
TO PREHEAT TIMER 1ASA3
FAULT RESET
1A1A1S1
(REF)
FAULT RESET NOT
+15 V
FROM BPS CONTROL 1A1A2A2
BEAM RDY
DIFF AMPL
FF
BEAM R.T. METER RELAY DRIVE NOT
TO RELAY 1A1A1K5
1A1A1K3
(REF)
BEAM CONTACTOR VRFY NOT
+15 V
DIFF AMPL
BEAM TURNON CMD
TO BPS CONTROL 1A1A2A2
FROM FAULT SUMMARY AND DRIVER 1ASA1
BEAM ON CMD
DIFF AMPL
DELAYED 15 VPS RELAY DRIVE NOT
TO RELAY 1A1A1K4
DELAY CKT
1A1A2A3 (REF)
+15 V
1A1A1K2
(REF)
ϕ SEQ FAULT NOT
200 ms DELAY
FF
ϕ LOCK
BEAM ϕ LOCK FAULT IND NOT
+15 V
ϕ SEQ
BEAM ϕ SEQ FAULT IND NOT
+15 V
1A1A1 (REF)
ϕ LK FAULT
DIFF AMPL
FROM BPS CONTROL 1A1A2A2
DIFF AMPL
KPS SUMMARY FAULT CMD
TO PREHEAT TIMER 1ASA3
BPS HI CUR
+15 V
1A1A1 (REF)
BEAM O.C. FLT
DIFF AMPL
DIFF AMPL
BEAM O.C. FAULT IND NOT

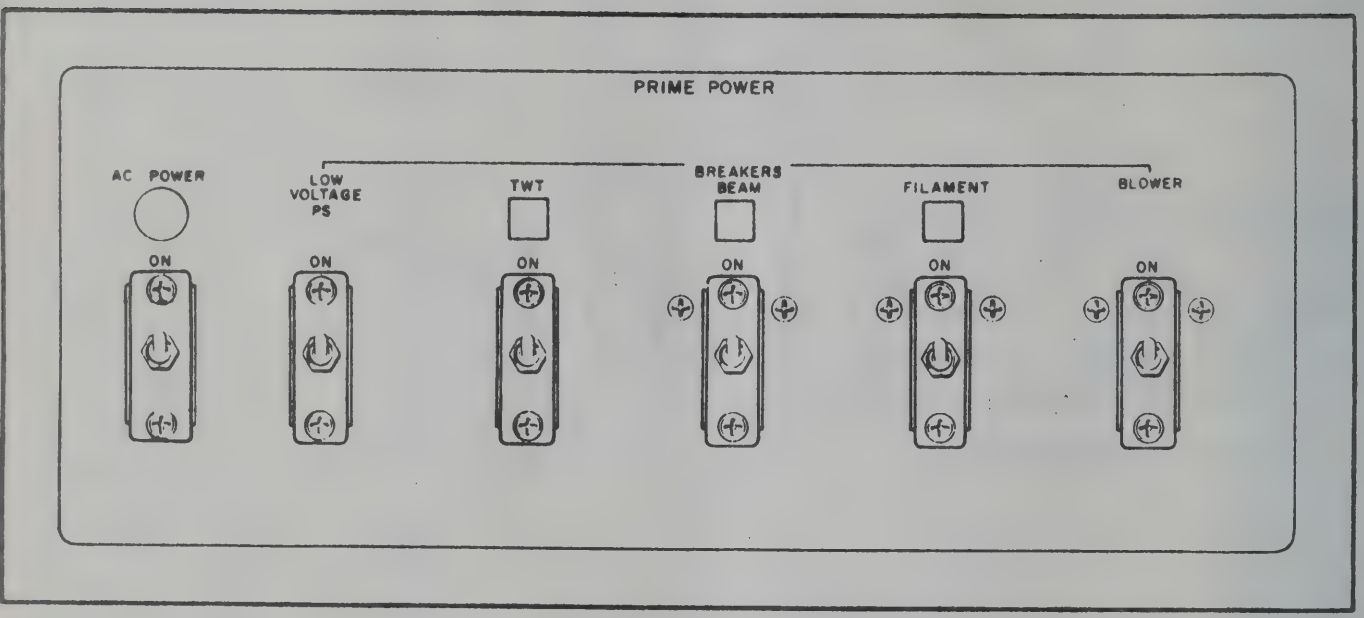


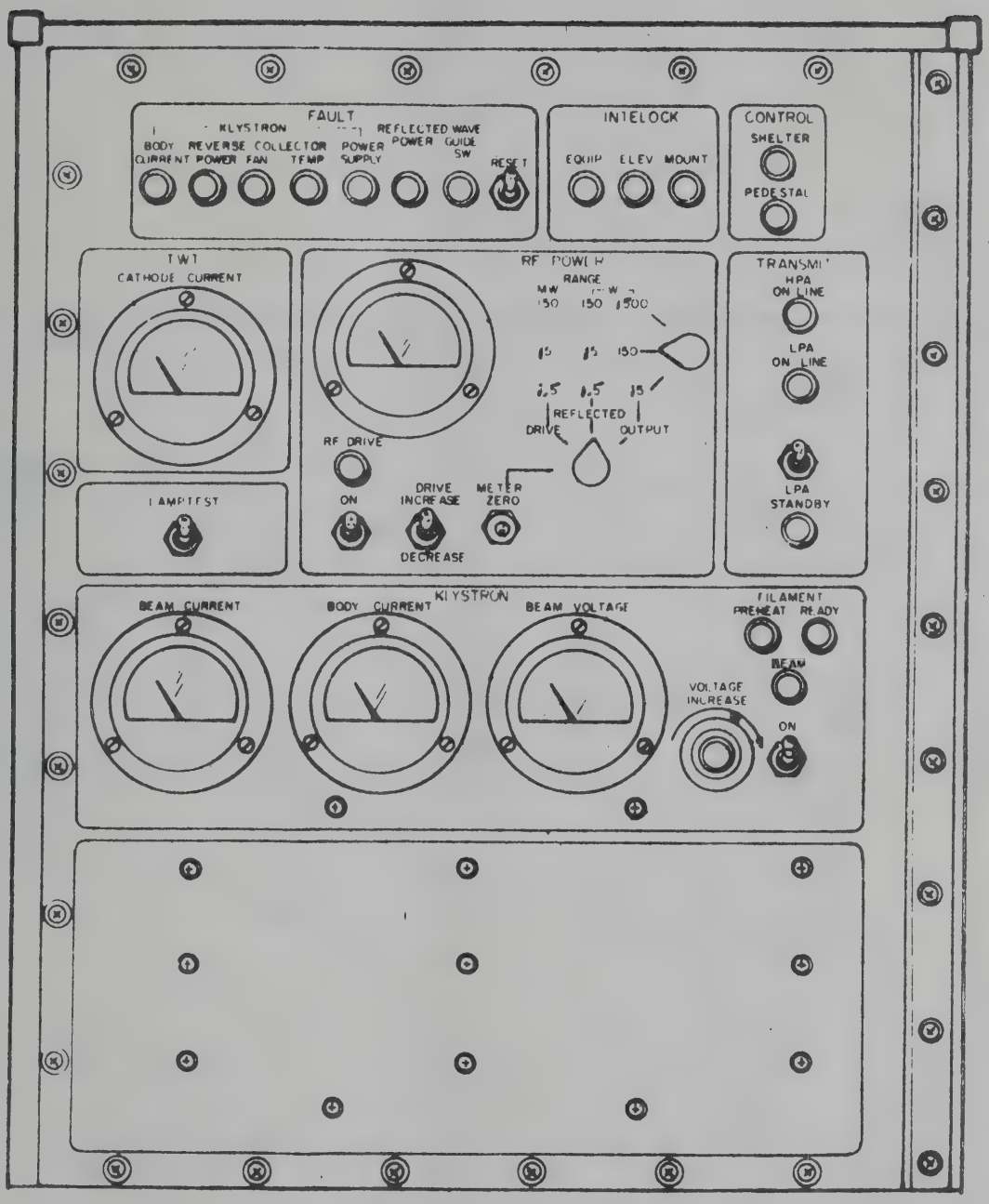
CONTROL-INDICATOR C-10252/G

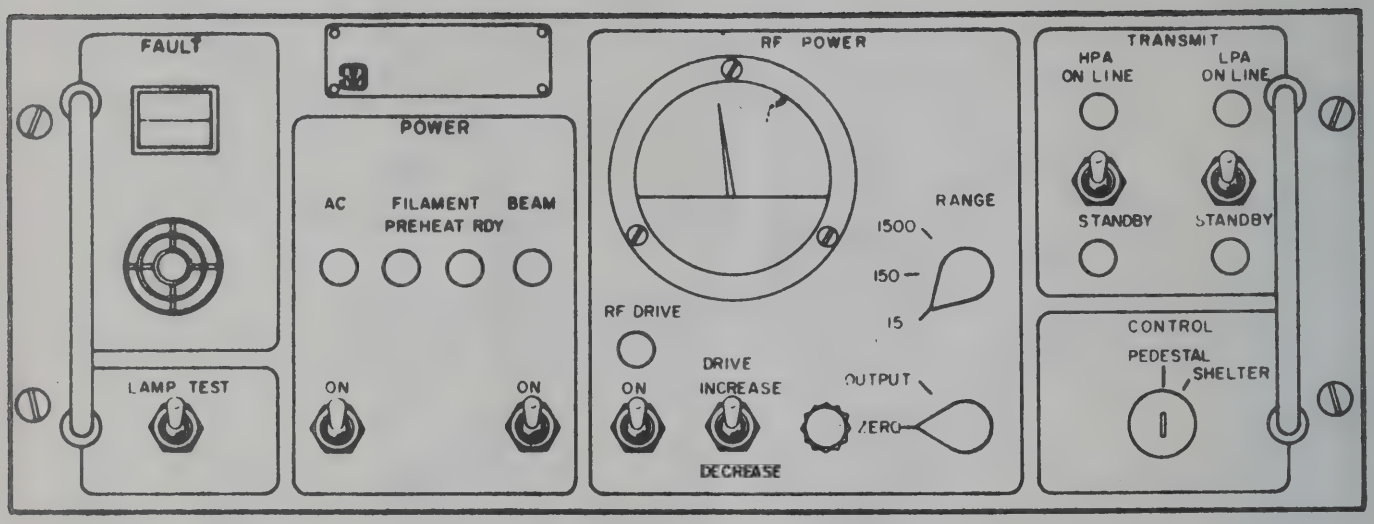


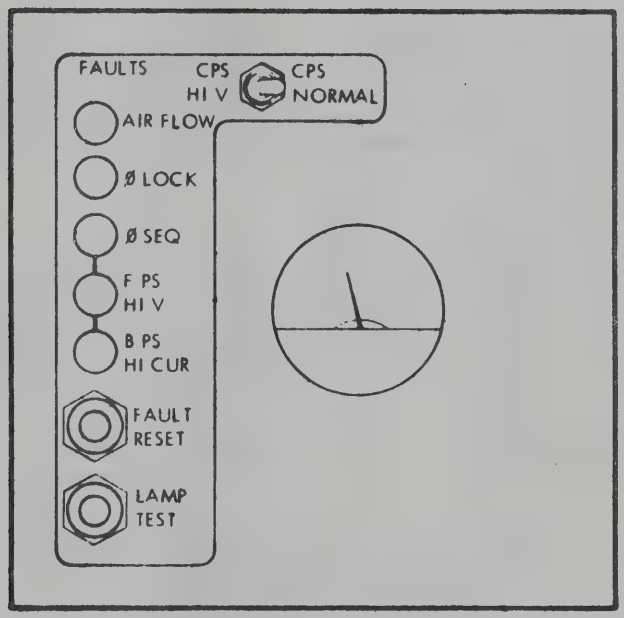
RF AMPLIFIER AM-6929/G

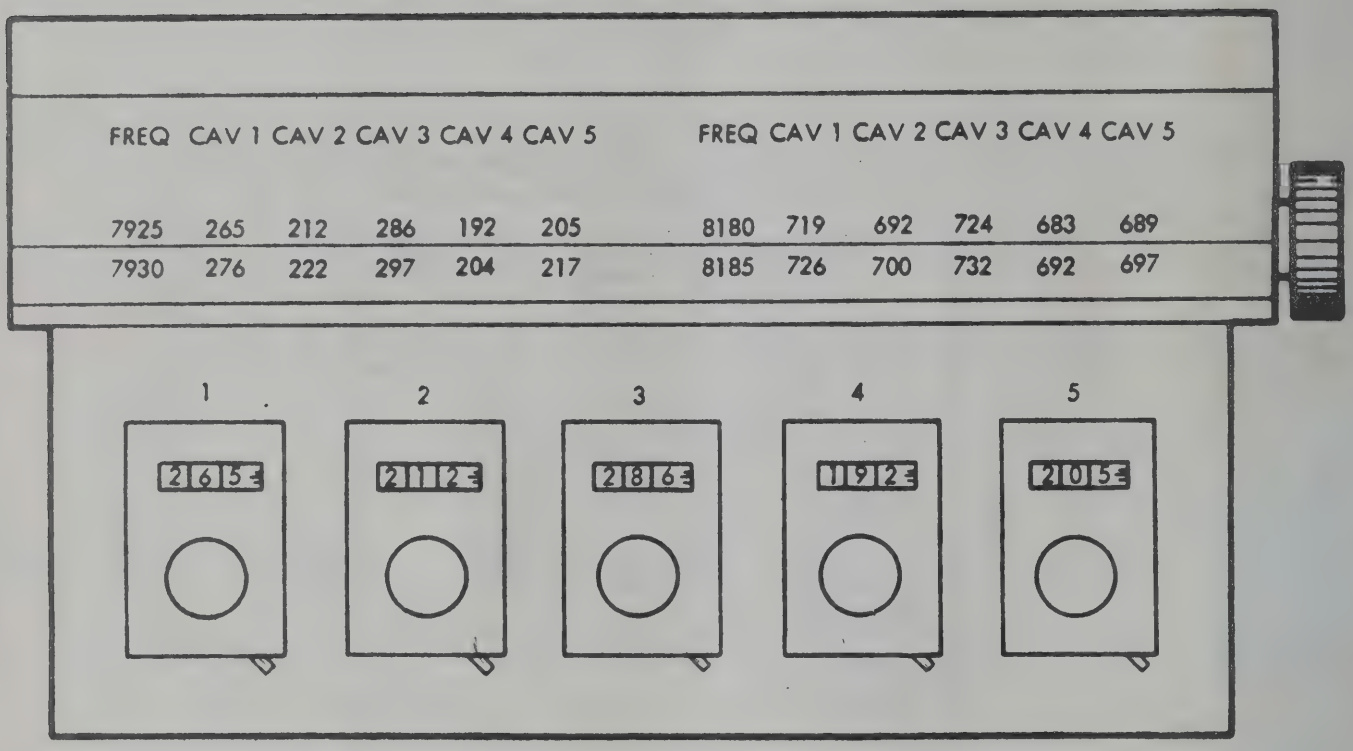
EL1YO001

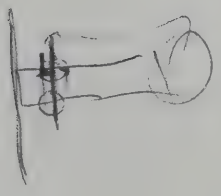

PRIME POWER
AC POWER
LOW VOLTAGE PS
TWT
BREAKERS BEAM
FILAMENT
BLOWER
ON
ON
ON
ON
ON
ON


FAULT
KLYSTRON
BODY CURRENT
REVERSE POWER
COLLECTOR FAN
TEMP
POWER SUPPLY
REFLECTED POWER
WAVE GUIDE SW
RESET
INTELOCK
EQUIP
ELEV
MOUNT
CONTROL
SHELTER
PEDESTAL
TWT
CATHODE CURRENT
LAMP TEST
RF POWER
RANGE
MW
W
150
150
1500
15
15
150
1.5
1.5
15
REFLECTED
DRIVE
OUTPUT
RF DRIVE
ON
DRIVE INCREASE
DECREASE
METER ZERO
TRANSMIT
HPA ON LINE
LPA ON LINE
LPA STANDBY
KLYSTRON
BEAM CURRENT
BODY CURRENT
BEAM VOLTAGE
FILAMENT
PREHEAT
READY
BEAM
ON
VOLTAGE INCREASE

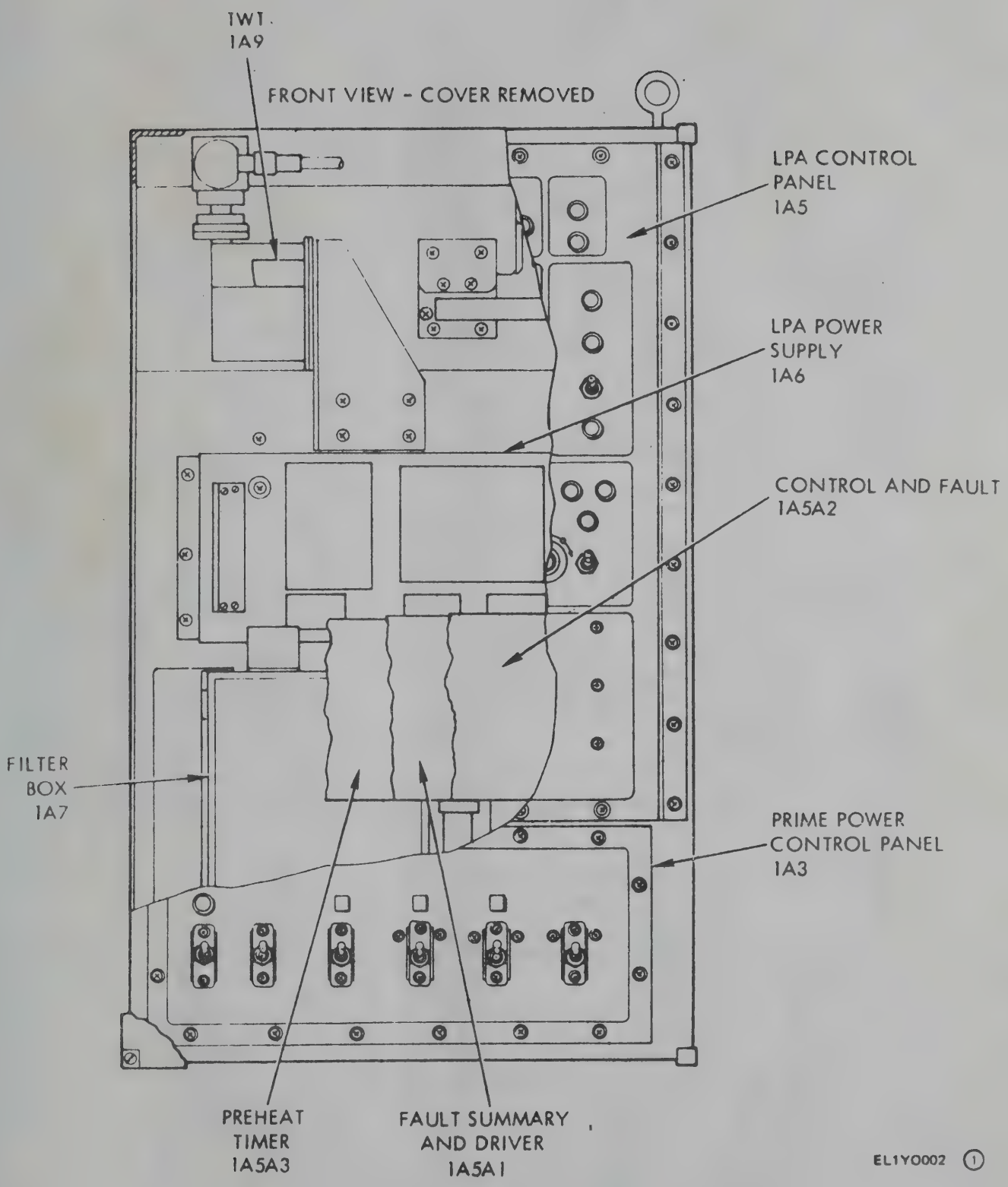

FAULT
LAMP TEST
POWER
AC
FILAMENT
PREHEAT RDY
BEAM
ON
ON
RF POWER
RANGE
1500
150
15
RF DRIVE
ON
DRIVE
INCREASE
DECREASE
OUTPUT
ZERO
TRANSMIT
HPA
ON LINE
LPA
ON LINE
STANDBY
STANDBY
CONTROL
PEDESTAL
SHELTER

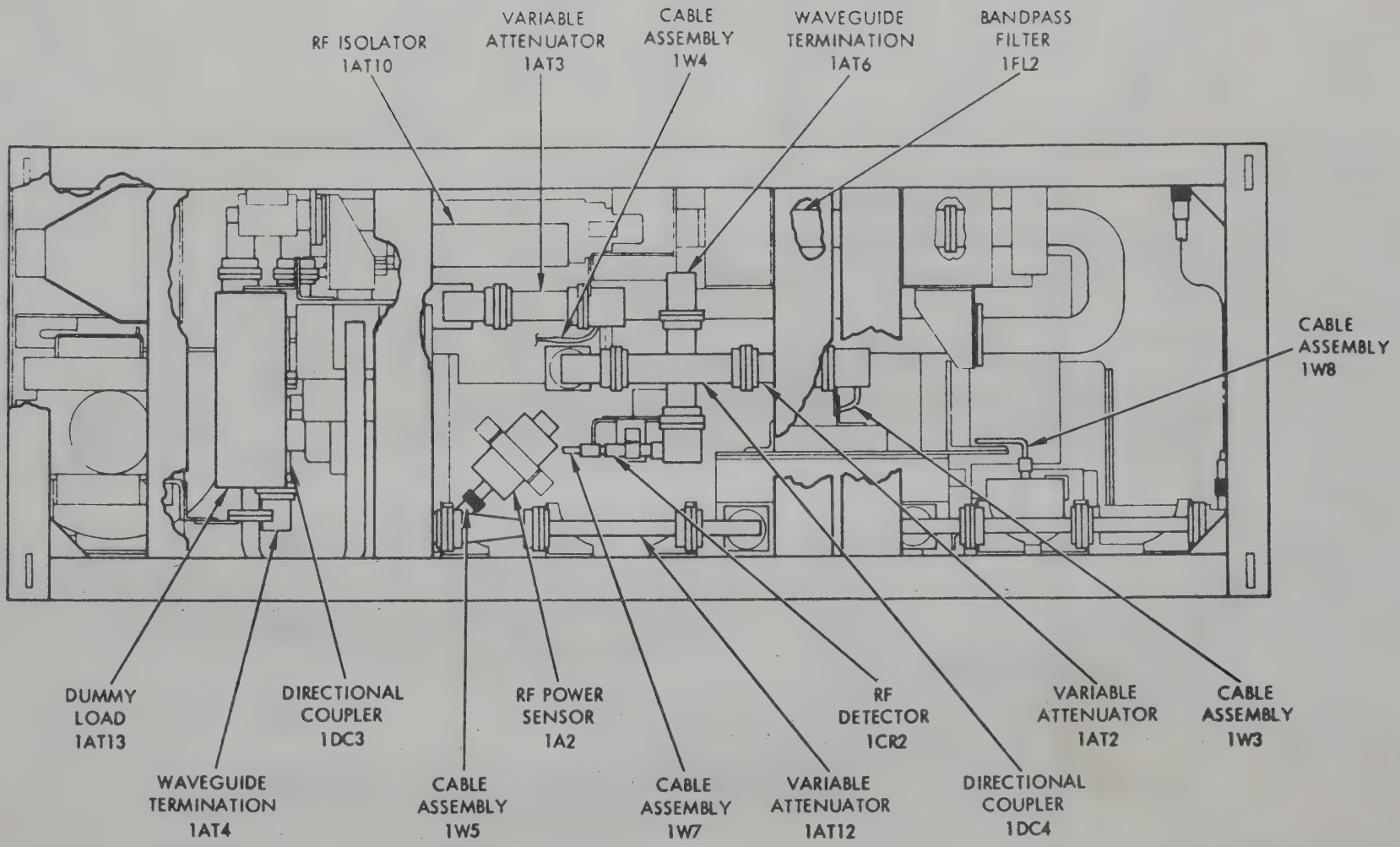

FAULTS
CPS HI V
CPS NORMAL
AIR FLOW
Ø LOCK
Ø SEQ
F PS HI V
B PS HI CUR
FAULT RESET
LAMP TEST


FREQ CAV 1 CAV 2 CAV 3 CAV 4 CAV 5
FREQ CAV 1 CAV 2 CAV 3 CAV 4 CAV 5
7925 265 212 286 192 205
8180 719 692 724 683 689
7930 276 222 297 204 217
8185 726 700 732 692 697
1
2
3
4
5
2 6 5
2 1 2
2 8 6
1 9 2
2 0 5



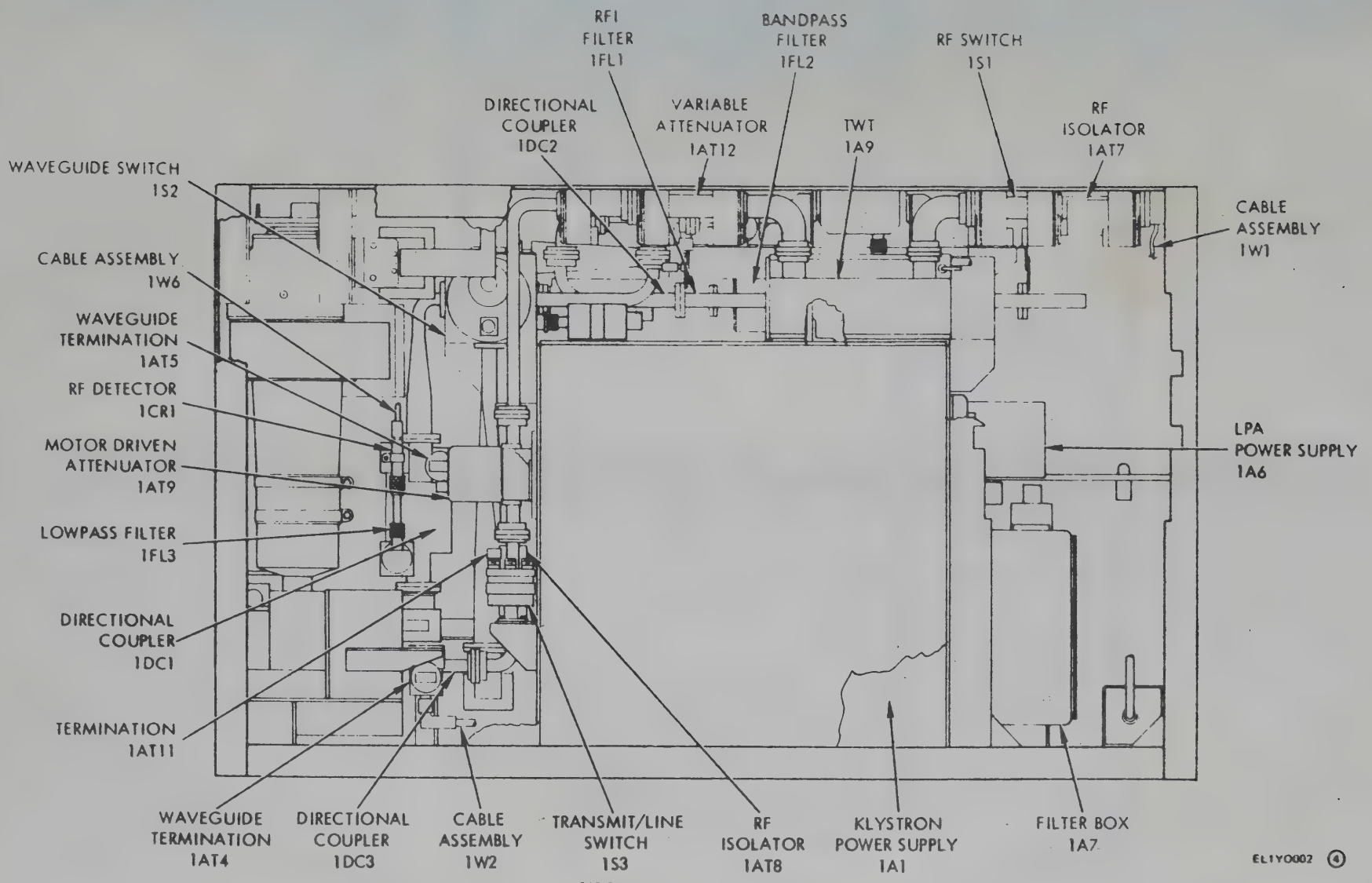
Change 1


TWT
1A9
FRONT VIEW - COVER REMOVED
LPA CONTROL
PANEL
1A5
LPA POWER
SUPPLY
1A6
CONTROL AND FAULT
1A5A2
FILTER
BOX
1A7
PRIME POWER
CONTROL PANEL
1A3
PREHEAT
TIMER
1A5A3
FAULT SUMMARY
AND DRIVER
1A5A1
EL1YO002 ①

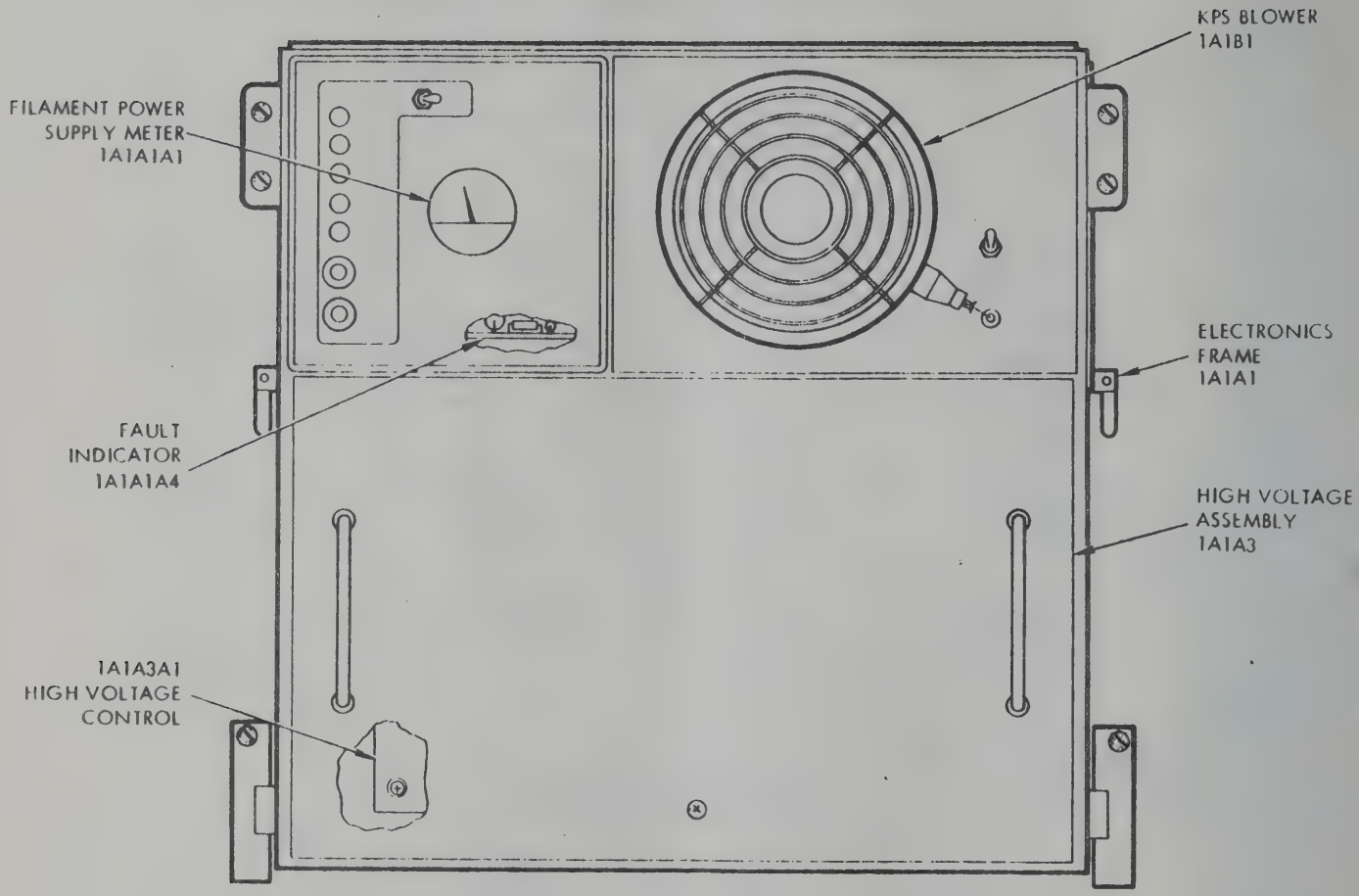


TOP VIEW - COVERS REMOVED

EL1YO002 ③

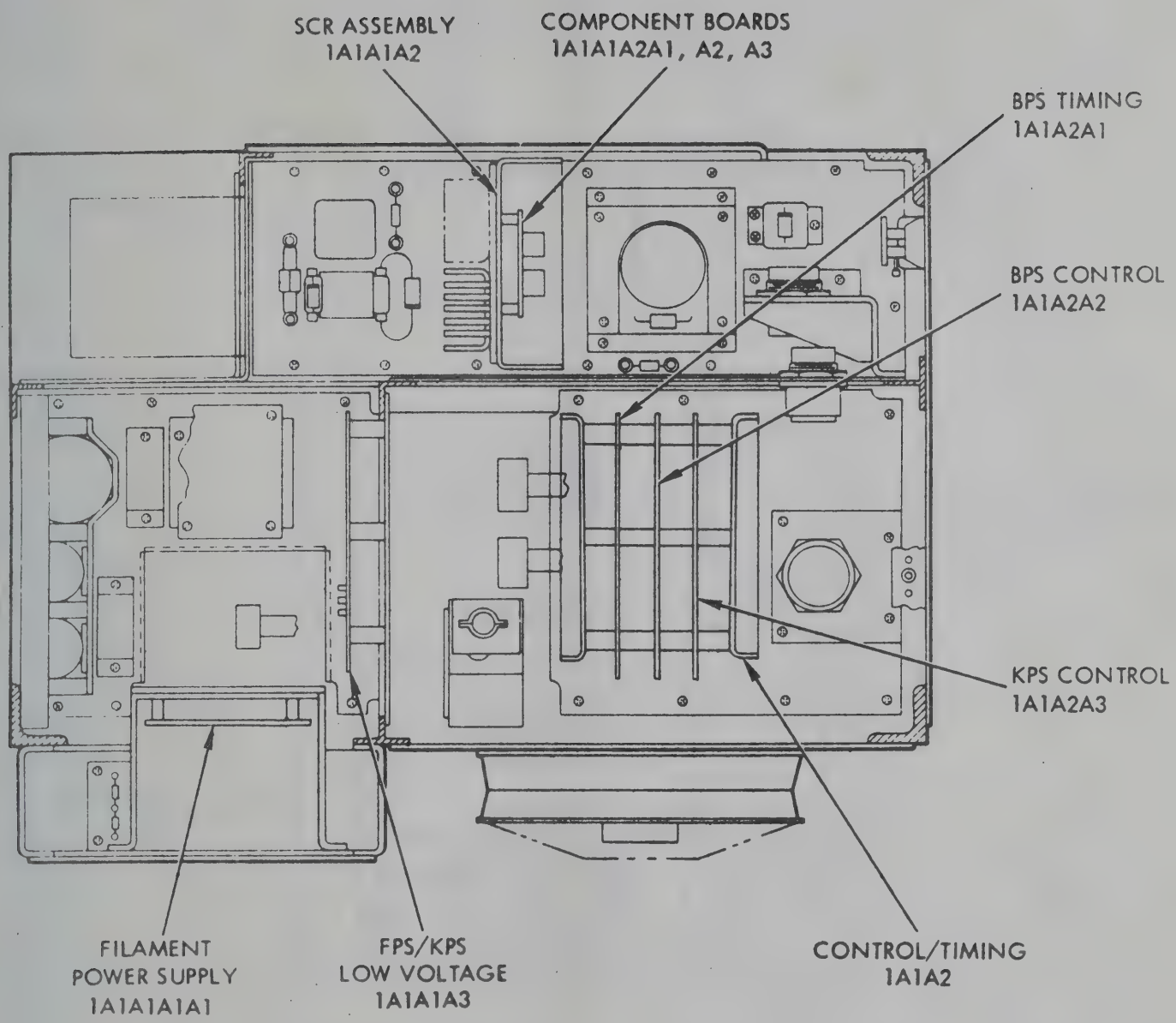


SIDE VIEW - COVERS REMOVED



KLYSTRON POWER SUPPLY 1A1 - FRONT VIEW

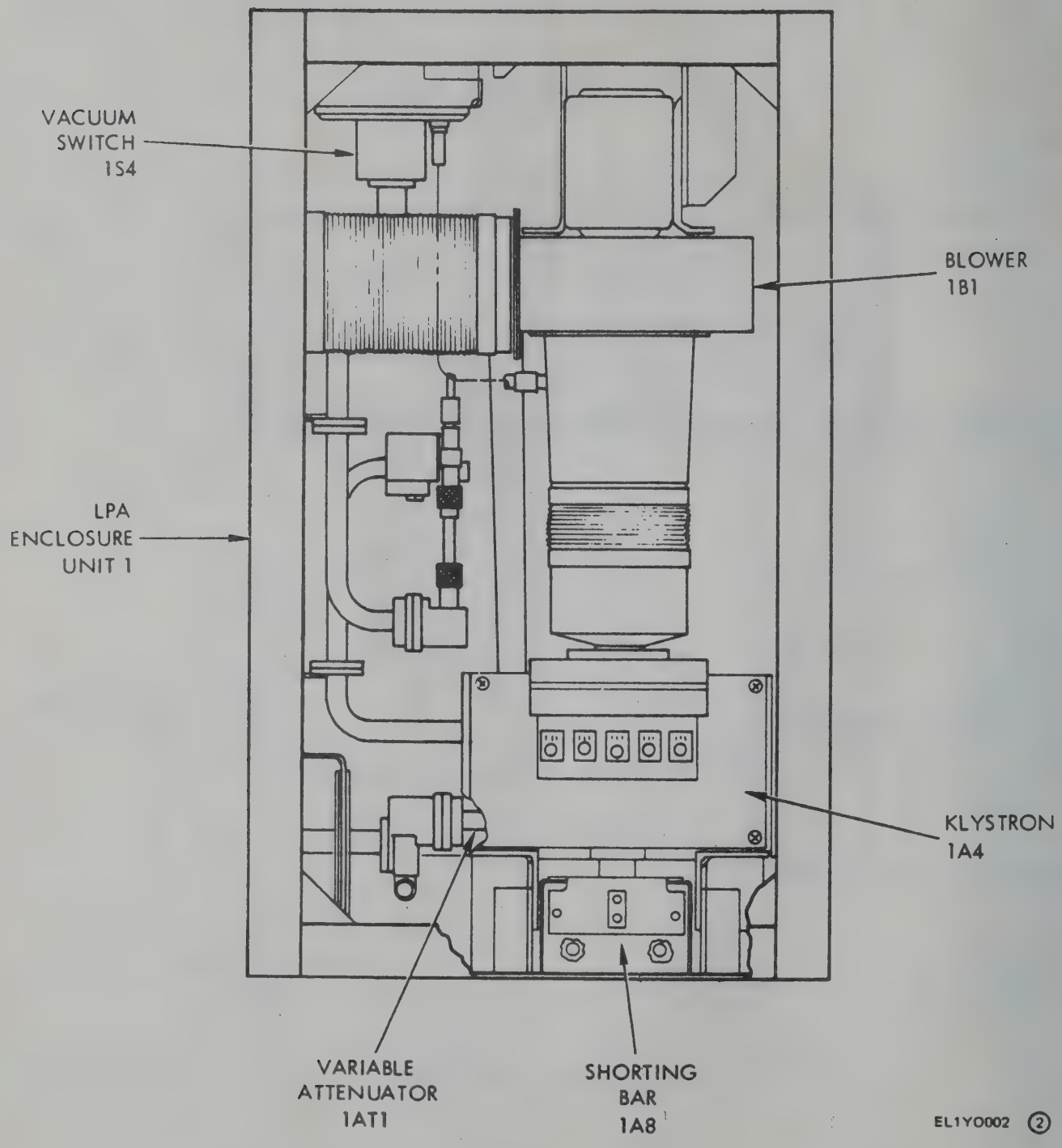
ETYG002 (1)



KLYSTRON POWER SUPPLY 1A1 - TOP VIEW

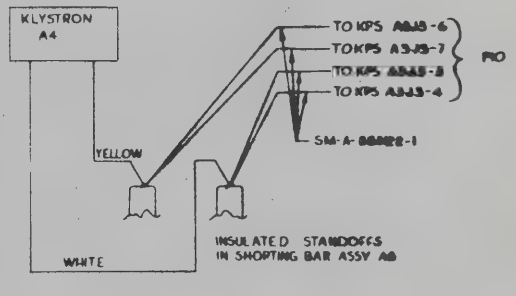
EL1YO002 (5)

REAR VIEW - COVER REMOVED

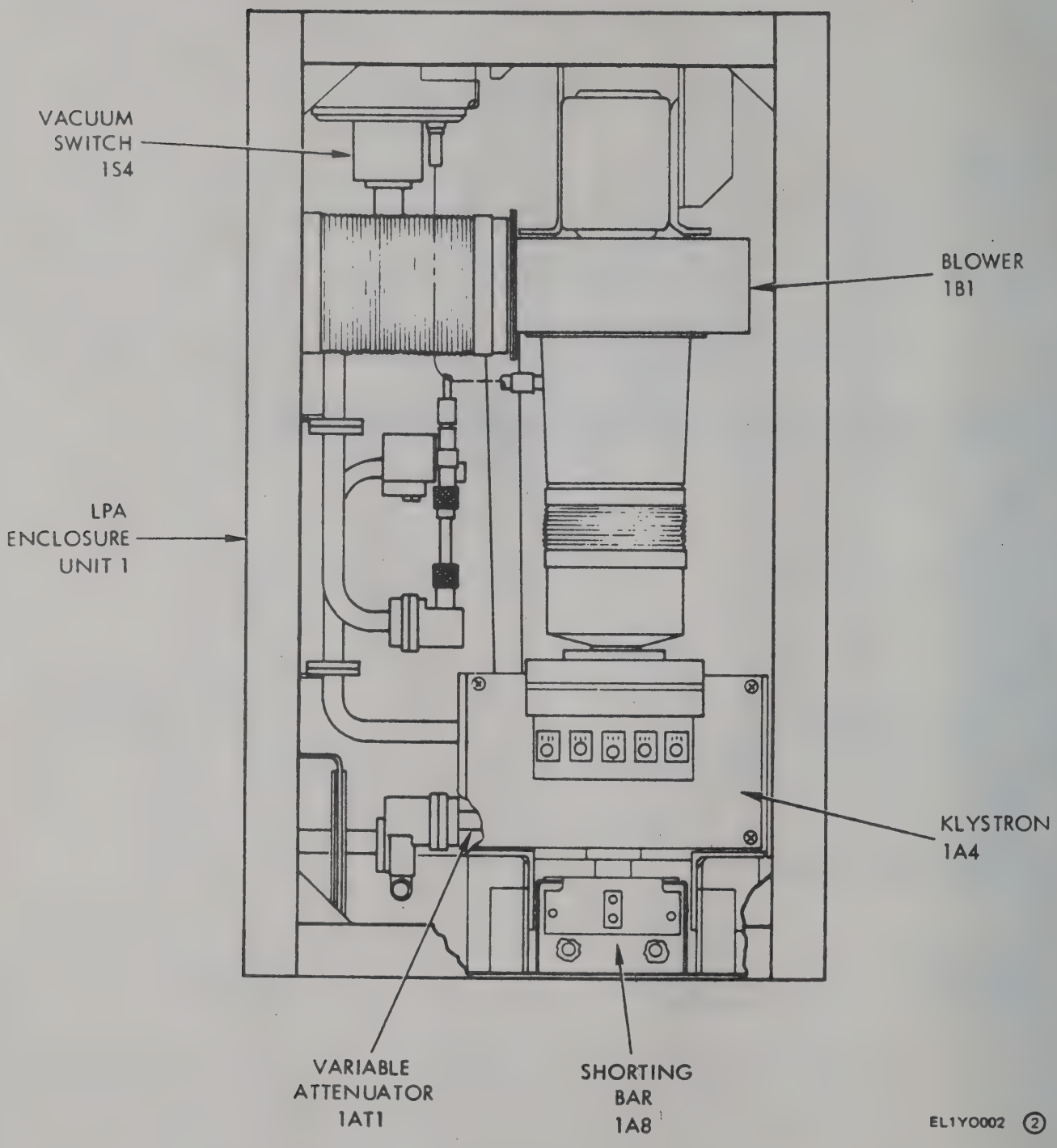


NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL WIRE IS 20 AWG (WHITE).

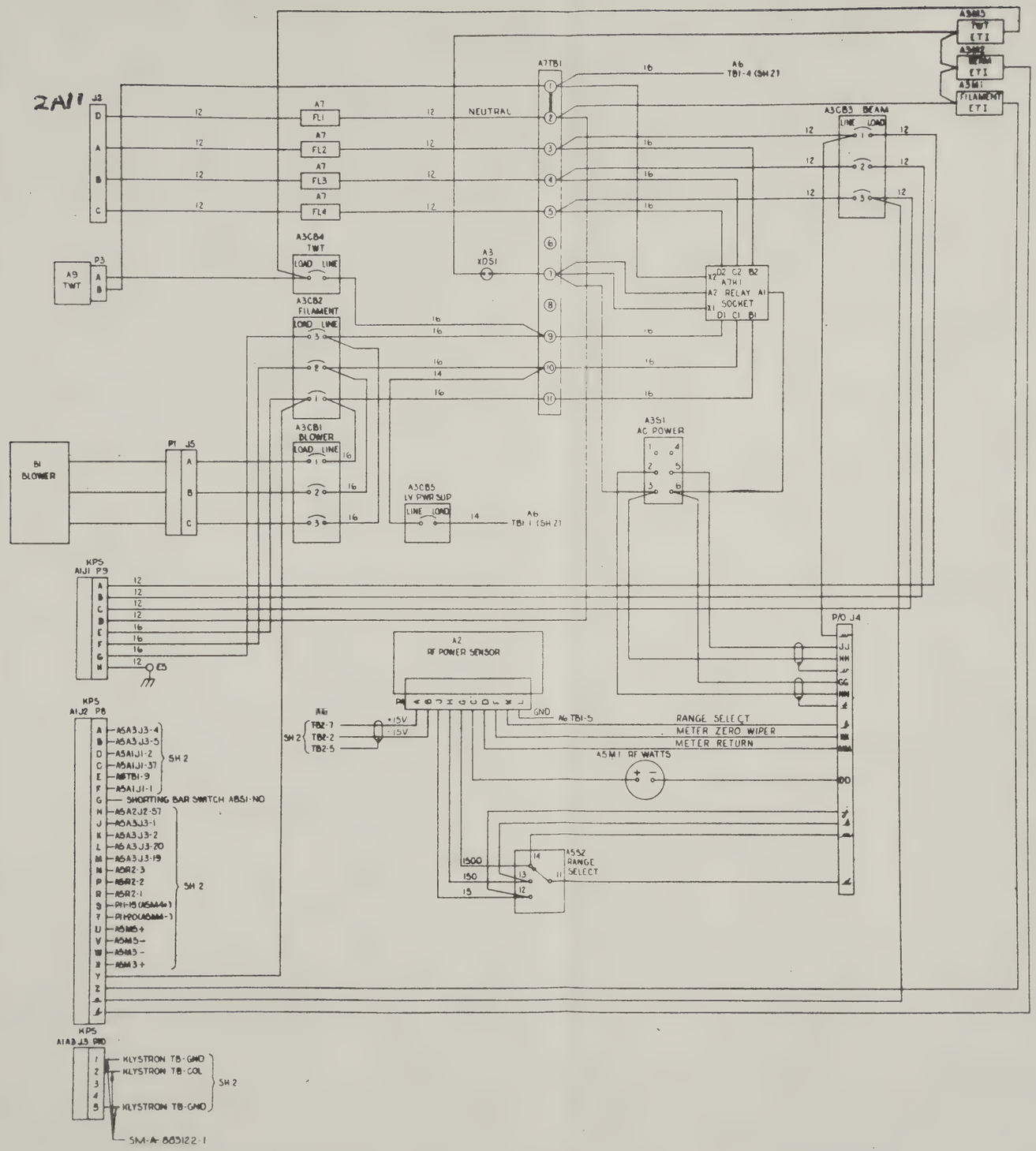


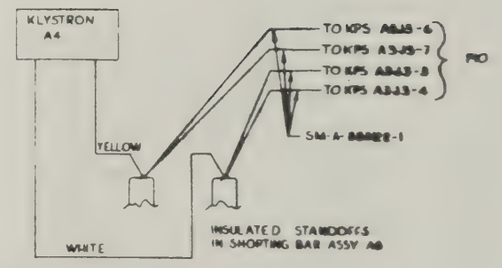
REAR VIEW - COVER REMOVED

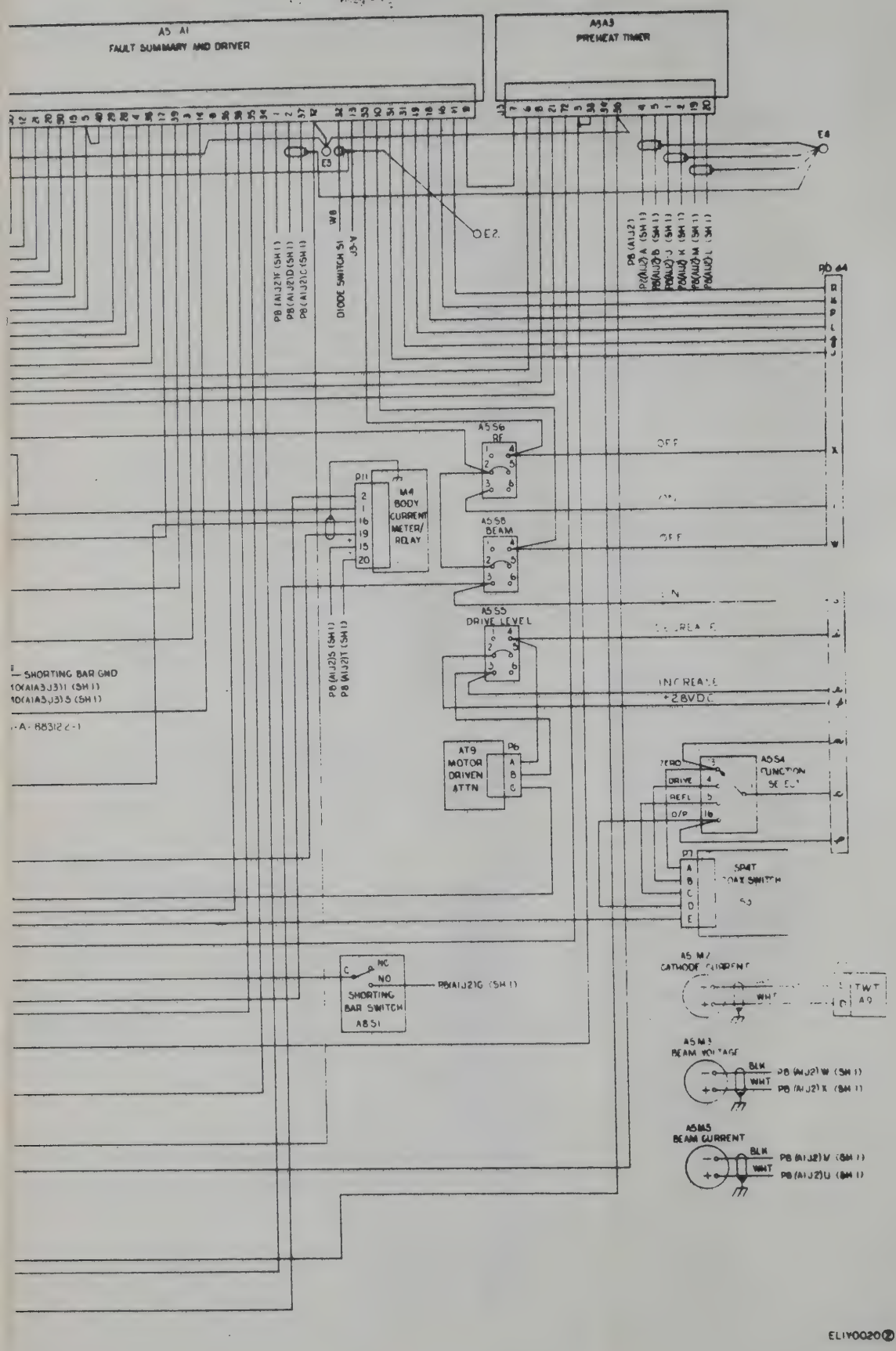


EL1YO002 (2)

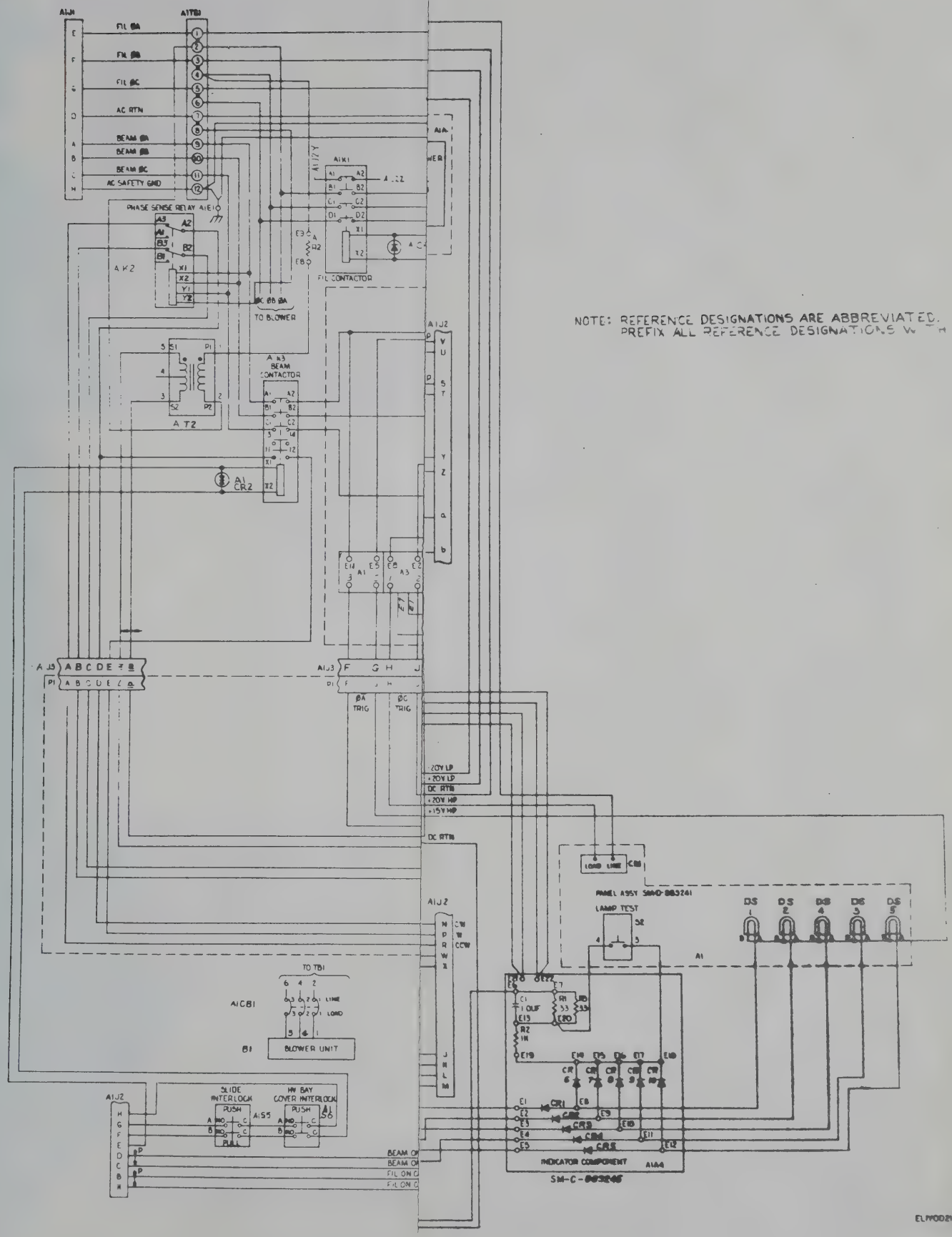
NOTES.
1. UNLESS OTHERWISE SPECIFIED ALL WIRE IS 20 AWG (WHITE)

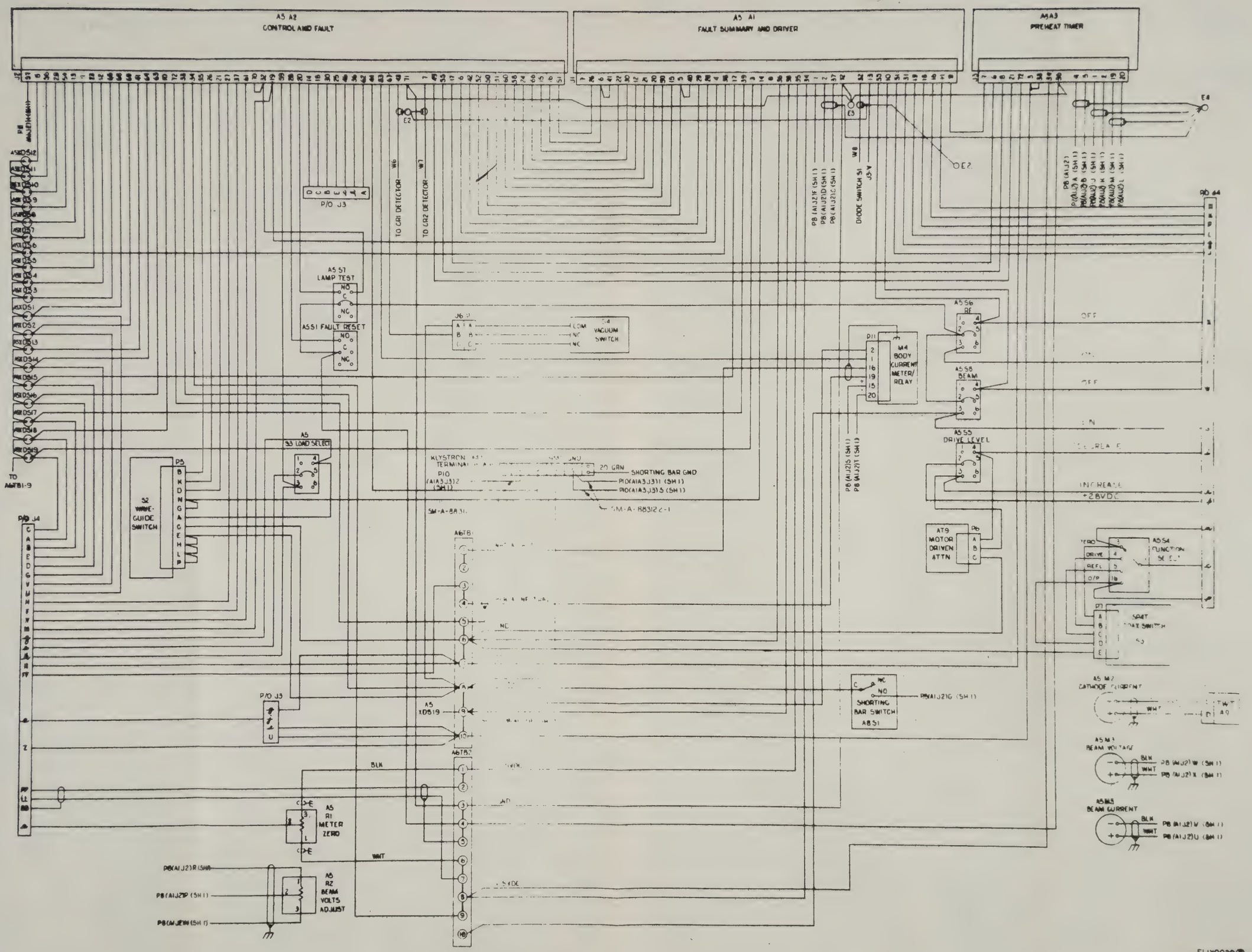


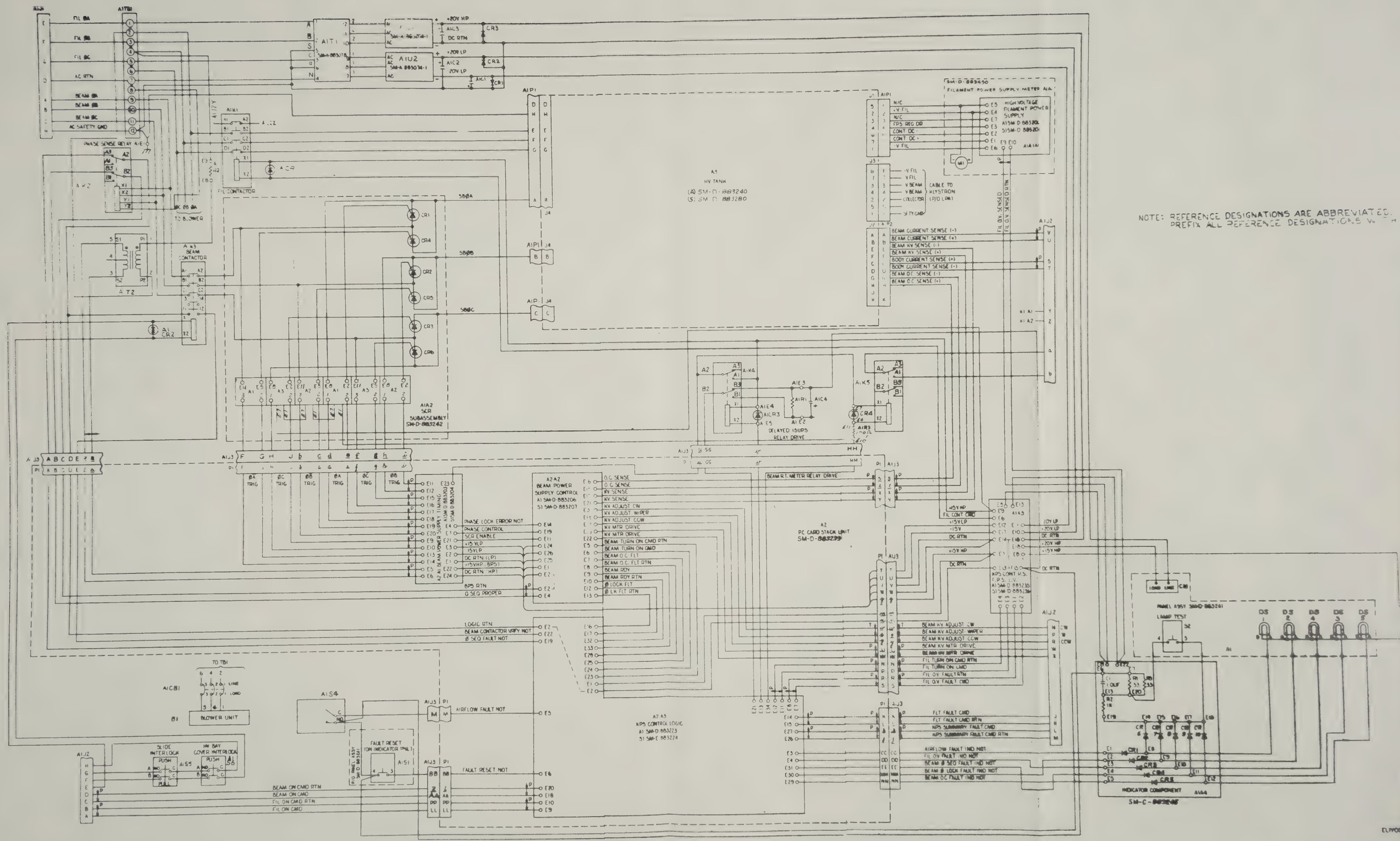



A5 A1
FAULT SUMMARY AND DRIVER
A5A3
PREHEAT TIMER
J13
E3
E4
DIODE SWITCH S1
W8
J5-4
P8 (A1J2)
P8(A1J2)A (SH 1)
P8(A1J2)B (SH 1)
P8(A1J2)J (SH 1)
P8(A1J2)K (SH 1)
P8(A1J2)M (SH 1)
P8(A1J2)L (SH 1)
P8 (A1J2)F (SH 1)
P8 (A1J2)D (SH 1)
P8 (A1J2)C (SH 1)
P8 44
A5S6
RF
OFF
P11
M4
BODY CURRENT METER/ RELAY
A5S8
BEAM
OFF
A5S5
DRIVE LEVEL
INCREASE
+28VDC
P8 (A1J2)S (SH 1)
P8 (A1J2)T (SH 1)
SHORTING BAR GND
10(A1A3J3)1 (SH 1)
10(A1A3J3)3 (SH 1)
A-88312(-1)
AT9
MOTOR DRIVEN ATTN
P6
A5S4
FUNCTION SELECT
ZERO
DRIVE
REFL
O/P
P7
SP4T
COAX SWITCH
S9
A5S1
SHORTING BAR SWITCH
NC
NO
P8(A1J2)G (SH 1)
A5M2
CATHODE CURRENT
WHT
TWT
A9
A5M3
BEAM VOLTAGE
BLK
WHT
P8 (A1J2)W (SH 1)
P8 (A1J2)X (SH 1)
A5M5
BEAM CURRENT
BLK
WHT
P8 (A1J2)V (SH 1)
P8 (A1J2)U (SH 1)

ELI90020(2)


NOTE: REFERENCE DESIGNATIONS ARE ABBREVIATED.
PREFIX ALL REFERENCE DESIGNATIONS W
A1J4
A1TB1
FIL ØA
FIL ØB
FIL ØC
AC RTN
BEAM ØA
BEAM ØB
BEAM ØC
AC SAFETY GND
PHASE SENSE RELAY A1E10
A1K2
TO BLOWER
FIL CONTACTOR
A1K1
A1J2
A1K3
BEAM CONTACTOR
A1T2
A1 CR2
A1J5
A1J3
ØA TRIG
ØC TRIG
+20V LP
-20V LP
DC RTN
+20V HP
+15V HP
A1J2
CW
CCW
TO TB1
A1CB1
LINE
LOAD
B1
BLOWER UNIT
A1J2
SLIDE INTERLOCK
HV BAY COVER INTERLOCK
A1S5
PUSH
PANEL ASSY SMD-883241
LAMP TEST
DS 1
DS 2
DS 3
DS 4
DS 5
A1
INDICATOR COMPONENT
A1A4
SM-C-883245


A5 A2
CONTROL AND FAULT
A5 A1
FAULT SUMMARY AND DRIVER
A5A3
PREHEAT TIMER
P/O J3
TO GR1 DETECTOR W6
TO GR2 DETECTOR W7
A5 S7
LAMP TEST
A5S1 FAULT RESET
J6
P4
VACUUM SWITCH
DIODE SWITCH S1
J3-V
W8
E2
E3
E4
OE2
P11
W4
BODY CURRENT METER/ RELAY
A5S6
RF
A5S8
BEAM
A5S5
DRIVE LEVEL
OFF
INCREASE
+28VDC
A5S4
FUNCTION SELECT
SPARE
A5 M2
CATHODE CURRENT
A5 M3
BEAM VOLTAGE
A5 M4
BEAM CURRENT
A5
S3 LOAD SELECT
S2
WAVE-GUIDE SWITCH
P5
P/O J4
TO A6TB1-9
KLYSTRON TERMINAL
P10
20 GRN
SHORTING BAR GND
P10(A1A3J331) (SH 1)
P10(A1A3J315) (SH 1)
SM-A-88312-1
SM-A-8831
A6TB1
A5 XDS19
SHORTING BAR SWITCH A5S1
A5 R1 METER ZERO
A5 R2 BEAM VOLTS ADJUST
BLK
WHT
RED
P/O J3
AT9 MOTOR DRIVEN ATTN
P6
ZERO
DRIVE
REFL
O/P
P7
SPARE
ELIY0020


NOTE: REFERENCE DESIGNATIONS ARE ABBREVIATED.
PREFIX ALL REFERENCE DESIGNATIONS W
A3
HV TANK
(A) SM-D-883240
(S) SM-D-883280
A2
PC CARD STACK UNIT
SM-D-883239
A2 A2
BEAM POWER
SUPPLY CONTROL
A1) SM-D-883206
S1) SM-D-883207
A2 A3
KPS CONTROL LOGIC
A1) SM-D-883223
S1) SM-E-883224
A1A2
SCR
SUBASSEMBLY
SM-D-883242
SM-D-883450
FILAMENT POWER SUPPLY METER A1A
A1A4
INDICATOR COMPONENT
SM-C-883240
PANEL A15Y SM-D-883241
LAMP TEST
PHASE SENSE RELAY A1E10
A1K2
A1K3
BEAM CONTACTOR
A1T2
FIL CONTACTOR
TO BLOWER
TO TB1
A1CB1
BLOWER UNIT
A1S4
AIRFLOW FAULT NOT
A1S5
SLIDE INTERLOCK
HV BAY COVER INTERLOCK
A1S1
FAULT RESET (ON INDICATOR PNL)
FAULT RESET NOT
BEAM ON CMD RTN
BEAM ON CMD
FIL ON CMD RTN
FIL ON CMD
+20V HP
+20V LP
DC RTN
-20V LP
+15V HP
+15V LP
-15V
DELAYED 150PS RELAY DRIVE
BEAM RT. METER RELAY DRIVE
PHASE LOCK ERROR NOT
PHASE CONTROL
SCR ENABLE
DC RTN (LP)
+15VHP (BPS)
DC RTN (HP)
BPS RTN
Ø SEQ PROPER
LOGIC RTN
BEAM CONTACTOR VERIFY NOT
Ø SEQ FAULT NOT
BEAM HV ADJUST CW
BEAM HV ADJUST WIPER
BEAM HV ADJUST CCW
BEAM HV MTR DRIVE
BEAM HV MTR DRIVE RTN
FIL TURN ON CMD RTN
FIL TURN ON CMD
FIL OV FAULT RTN
FIL OV FAULT CMD
FLT FAULT CMD
FLT FAULT CMD RTN
KPS SUMMARY FAULT CMD
KPS SUMMARY FAULT CMD RTN
AIRFLOW FAULT IND NOT
FIL OV FAULT IND NOT
BEAM Ø SEQ FAULT IND NOT
BEAM Ø LOCK FAULT IND NOT
BEAM OC FAULT IND NOT
SBØA
SBØB
SBØC
CABLE TO KLYSTRON (P/O L.PA)
BEAM CURRENT SENSE (-)
BEAM CURRENT SENSE (+)
BEAM KV SENSE (-)
BEAM KV SENSE (+)
BODY CURRENT SENSE (+)
BODY CURRENT SENSE (-)
BEAM OC SENSE (-)
BEAM OC SENSE (+)
HIGH VOLTAGE FILAMENT POWER SUPPLY
A15M D-883201
A15M D-883202
A1A1A1
FIL OV SENSED
FIL OV SENSED RTN
DELAYED TRIG
A1K4
A1K5
A1E3
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A1R1
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A1C1
A1R2
A1R3
A1E9
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END

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ANTENNA CONTROL SUBSYSTEM

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Section VI. ANTENNA CONTROL SUBSYSTEM THEORY

2-25. Antenna Control Subsystem Block Diagram Analysis.

The function of the Antenna Control Subsystem (fig. 2-10) is to point the antenna at the satellite and keep the satellite within the antenna beamwidth by various tracking procedures so that communications can be supported. In order to perform this function the Antenna Control Subsystem requires a signal from the satellite, which is processed through a receiver. This is normally the Beacon demodulator, but may be a communications demodulator under abnormal conditions. The demodulator output signal then is used in the Antenna Control Subsystem. It should be noted that specific portions of the subsystem are not complete in the block diagram but are terminated in logic blocks. The block diagram, therefore, shows the functions which are initiated by the logic outputs even though logic functions are described separately (par. 2-26).

a. Receiver Select. Tracking signals are selected by the RECEIVER SELECT switch located behind the antenna control panel normally set to BEACON RECEIVER position. In this position the Antenna Control Subsystem receives a synchronous detector error signal and an envelope detector signal. The receiver select relay switch normally selects the synchronous detector signal, but when a forced track indicator command is received from the logic the relay armature is energized. This action switches the contacts to the envelope detector signal.

b. Signal Strength Monitoring. The RECEIVER SELECT switch also provides the input for signal strength monitoring. If the satellite is tracked in the pencil beam mode there will be no error signal from the Beacon receiver. The only indications of a signal will be deflection of the signal strength meter, and the probable lighting of the SIGNAL DETECT and PHASE LOCK lamp indicators if the signal is strong enough. The signal strength meter then will serve as the monitor for manual positioning of the antenna. The meter signal is the agc signal from the Beacon receiver.

c. Satellite Detect and Phase Lock Detect Logic Input. When a satellite detect signal is received, the signal detect switch contacts open to activate the satellite detection command logic. Phase lock detect information is fed to the logic circuits to generate phase lock logic. The positioning error signal is fed to the two amplifiers shown in the block diagram with buffered outputs taken from each amplifier and fed through a summer to the phase demodulator.

d. Error Signal Phase Demodulator. The function of the phase demodulator is to separate the error signal into azimuth and elevation axis components. Further, each of the component parts are separated into specific polarities. This is possible because the error signal initially is sequentially generated by the ferrite digital scanner using gating signals from the scan reference generator (next paragraph). The same type of signals (but delayed) are used prior to the phase demodulator. Thus, at any given time, three of the solid state switches for the aximuth and elevation axes are closed and one is opened. The switch which is opened permits the

error signal to be amplitude and phase detected. This results in demodulator outputs which are shown to better advantage in the tabulation below.

Azimuth	Elevation	Azimuth	Elevation	
t = 1+				At time t = 1 Azimuth + error is active and all others are 0.
	t = 2+			At t = 2 Elevation + and all others 0.
		t = 3-		At t = 3 Azimuth - and all others 0.
			t = 4-	At t = 4 Elevation - and all others 0.

e. Scan Reference Generator. Reference gating signals are generated by the scan reference generator. The 400 cps reference voltage is rectified and the unfiltered positive voltage is used to trigger a monostable multivibrator. This is frequency divided to 100 cps and the output square wave is used to drive two ring counters. The ring counters develop timing pulses at a 25 cps rate, and these pulses are used for the ferrite digital scanner and the phase demodulator.

f. Position Loop Amplifier. Azimuth and elevation error signals from the phase demodulator are fed to the position loop amplifier. Note that at this point there is a selection of input signals other than the tracking signals. The track/scan relay switch selects the scan amplifier output when the track relay command is not

present (relay deenergized). The scan amplifier is also driven by two signal sources as shown on the diagram. The scan relay switch provides the means to use the bar scan generator output for antenna scanning. Pressing the BAR SCAN switch energizes the relay armature which permits the sweep signal to be fed through the track/scan, amplifier caging, and standby relays to the position loop amplifier. The bar scan functions are expanded in paragraph g below.

(1) At the input of the position loop amplifier the relays described above connect any one of three major signal sources with positioning information which is amplified before routing to the tach loop. All antenna positioning signals combine at this point with the exception of slewing and position memory signals.

(2) The amplifier caging relay functions to effectively remove the position loop amplifier as an antenna positioning signal source when the relay is energized. A typical case would be antenna slewing procedure (paragraph h. below).

(3) The standby relay functions to close the loop comprised of the position loop amplifier, tach loop, and power amplifier when in standby. This stabilizes the loop against transients. Application of a not standby command energizes the relay switch and feeds the selected signal into the position loop amplifier. The resulting output signal may then be modified by selection of a wide or narrow band. A narrow band command energizes the narrow band relay to switch in a narrow low-pass filter

network into the feedback loop. This command is generated by switch selection at the antenna console front panel. The elevation control circuits in the position loop amplifier are functionally the same as the azimuth circuits.

g. Bar Scan Generator. The bar scan generator essentially consists of two oscillators with synchronization for the elevation axis oscillator obtained from the azimuth axis oscillator. Analysis of the azimuth scan generator in the block diagram shows that the azimuth oscillator is comprised of two amplifiers functioning as a sawtooth oscillator. The oscillator switch amplifier generates a square wave with its amplitude dependent on either the setting of the sector control potentiometer or the Zener diodes connected across the output. The Zener diodes determine the peak amplitude of the output square wave. The output is fed to the sawtooth generator amplifier which provides a symmetrical sawtooth wave. The slope of the sawtooth waveform (and directly, the frequency) is dependent on the setting of the rate control potentiometer. The square wave output of the oscillator switch is fed also to a unijunction and logic circuit which provides sync for the elevation axis oscillator. The sync drives a solid state elevation scan interrupt switch so that the timing combination of the aximuth and elevation axis waveforms are as shown in the waveform timing on the diagram. Note that the riser part of the staircase waveform determines the amount which the antenna will move on the elevation axis at the end of each azimuth trace, and the number of steps determines the maximum elevation excursion from the selected reference position at which the search scan is

initiated. The selected reference position is operator-controlled by either rate augment or operation of the manual positioning controls at the front panel. Rise time of the elevation axis is almost instantaneous, consequently the antenna must respond rapidly in order to effect a parallel line sweep. To aid in this transition, a boost is supplied to the tach loop amplifier by the elevation scan feed forward signal. Resulting antenna movement is then as shown in the up and down curves in the waveform timing block.

h. Tach Loop. Tach loop circuits provide three important functions for each of the axes:

(1) Slewing capability is provided through the slew relay which is activated by moving the AZIMUTH SLEW control from the detent position. This action generates the slew relay command and switches the slew relay contacts to the slew potentiometer. The selected voltage is summed with any error signal present and goes through the slew summing amplifier to the tach loop amplifier where it is summed with the tach feedback signal.

(2) Position memory is used to re-position the antenna to the point of initial signal detection while searching. During bar scan, the position memory loop is enabled to remember antenna position by integrating tachometer output. During search the integrate switch contacts are closed, grounding the input by lack of an integrate switch command from logic. The not integrate switch is opened, which cages the position memory amplifier. On signal detection, a logic command lights the POSITION

MEMORY lamp, opens the position memory switch shunt to ground, and reverses the state of the integrate and not integrate switches. Antenna position at signal detection is thus sampled, and the antenna is returned to this point by position memory output. When phase lock occurs, the position memory is inhibited; if phase lock does not occur within four seconds of initial signal detection, the system reverts to the search mode being used.

(3) The tach loop is also fed by signals from the limiting control circuits. Antenna-coupled limit switches are activated when applicable limits (rate, servo, or electric) are exceeded. In addition, antenna rotation is sensed to determine the correct polarity to drive the antenna out of the limits sector when commanded by an electric limits override or servo limits command. The limit switch control relays supply two separate control voltages to the tach loop amplifier. These voltages are of opposite polarity to oppose the normal driving voltages. As an additional rate limiting factor, the tach loop amplifier output is diode-limited to 3 deg/sec.

i. Power Amplifier. The drive signal from the tach loop goes to the power amplifier which is a silicon-controlled rectifier (scr) bridge. The bridge is controlled by the low level dc drive signal through solid state circuitry. Output of the scr drives the dc motor to turn the antenna. If dc motor driving power is excessive, the torque limiting circuit is activated, and the feedback loop reduces scr output current.

(1) When the antenna goes into the standby mode drive power is removed through the armature contactor and the antenna brake is applied. The antenna brake requires power to disable (release).

(2) Logic circuitry generates the command which releases the antenna brake. This command energizes the $\overline{\text{not standby}}$ follower relay and provides a return for the interlock circuit as shown. This also provides a return for the antenna brake disable relay and results in both relays being energized. The relay contacts of the antenna brake disable relay then provides 90 vdc to actuate the brake solenoid and release the antenna.

j. Antenna Servo Followup Loop. The followup loop provides a positioning voltage to the position loop amplifier when the antenna is operated in any manual mode except slew. In the position loop amplifier (par. f above) the track/scan relay switch is the termination of the servo followup loop. Whenever a signal is not being tracked the relay is deenergized and connected into the scan and/or followup circuits dependent on the position of the scan relay. The followup error positioning signal is the only positioning signal into the position loop amplifier when the bar scan mode is not being used.

(1) The followup loop begins at the antenna with a resolver transmitter which generates a voltage corresponding to the position of the antenna. The voltage phase is dependent on the reference voltage fed to the rotor of the resolver. The stator winding output is then fed to the resolver transformer of the instrument servo in the antenna control chassis. The

followup resolver transformer output feeds an electro-mechanical loop when the followup resolver transfer relay is not energized. The electrical portion of the loop is from the resolver to the followup motor, and the loop is completed by mechanical linkage back to the rotor of the followup control transformer as shown by the dotted lines. Note that this followup loop may be opened at four points; the resolver transfer relay, the rate augment relay, the followup disable relay, and the mechanical interrupt at the followup brake. Assuming that the loop is completely closed as shown in the diagram, the followup loop input is fed back on itself with no positioning signal fed to the position loop amplifier. For this situation the followup resolver transformer position corresponds to the resolver transmitter coupled to the antenna with a subsequent indication of antenna position on the digital counter. This type of loop function is in effect during auto or forced track when it is desirable that the only signals into the position loop amplifier should be the tracking signals from the Beacon receiver or when slewing the antenna.

(2) In the handover mode, when a satellite is being tracked (normally in autotrack) and it is desired to switch track to another satellite, the followup loop provides the capability of continuing track while making preliminary procedural steps to facilitate quick pickup of the new satellite. If the FOLLOW UP DISABLE switch is pressed the followup disable relay contacts in the followup loop open, and thus there can be no input into

the followup loop amplifier. The azimuth positioning handwheels (elevation axis is identical) is clutched (enabled) which permits any desired azimuth position to be cranked in with the positioning handwheel. Since the followup brake is on, the mechanical linkage will be only from the positioning handwheel to the followup control transformer. Cranking the handwheel will turn the rotor of the resolver transformers and the digital indicator. When phase lock is lost the followup resolver relay is energized, which connects the followup resolver transformer output to the position loop amplifier, and the error signal positions the antenna. If the new position selected for the antenna is considerably away from the end-of-track position, slewing may be used to position the antenna near the selected location and the followup error signal will then complete the positioning.

(3) With the followup resolver relay energized and the antenna effectively at rest, any movement of the antenna caused by wind loading will result in a followup error voltage into the position loop amplifier which will cause the antenna to return to its former position. Similarly if the azimuth positioning handwheels should be cranked the antenna would be rotated with a scale factor of 1 degree per revolution of the handwheel.

(4) Under the same conditions as described in the preceding paragraph, if the RATE AUGMENT switch should be pressed, the rate augment relay would be energized. Any rate selected by positioning of the potentiometer is amplified by the loop amplifier which drives the loop motor.

The loop motor then drives the followup control transformer at a constant speed. The output signal of the transformer is then processed the same as the handwheel positioning signals except that the antenna will continue to rotate at the rate selected. Manual tracking is made easier once the operator knows the rate of movement of the satellite, through use of the RATE AUGMENT control. With a skilled operator, a minimum of handwheel positioning will be required to keep the satellite within the antenna beamwidth.

k. Phase Demodulators. The phase demodulators convert the ac error signal from the resolver transformer to a dc positioning error.

l. Analog Position Indicators. The analog position circuitry is conventional synchro with a torque transmitter antenna-coupled and a torque receiver located at the console. These position indicators give the antenna position at all times. During the handover made these indicators are the only means the operator has of knowing the position of the antenna. Accuracy is less than that of the digital position indicators (45 minutes of arc).

m. Program Mode Switching. Figure 2-11 shows the signal flow when operating in the program mode. The resolver control transformer output is fed to the programmer which processes the data and generates data output as positioning information to the position loop amplifier. Note that the program relay is energized by logic command and thus switches in the programmer output. The required logic is described in paragraph 2-26g.

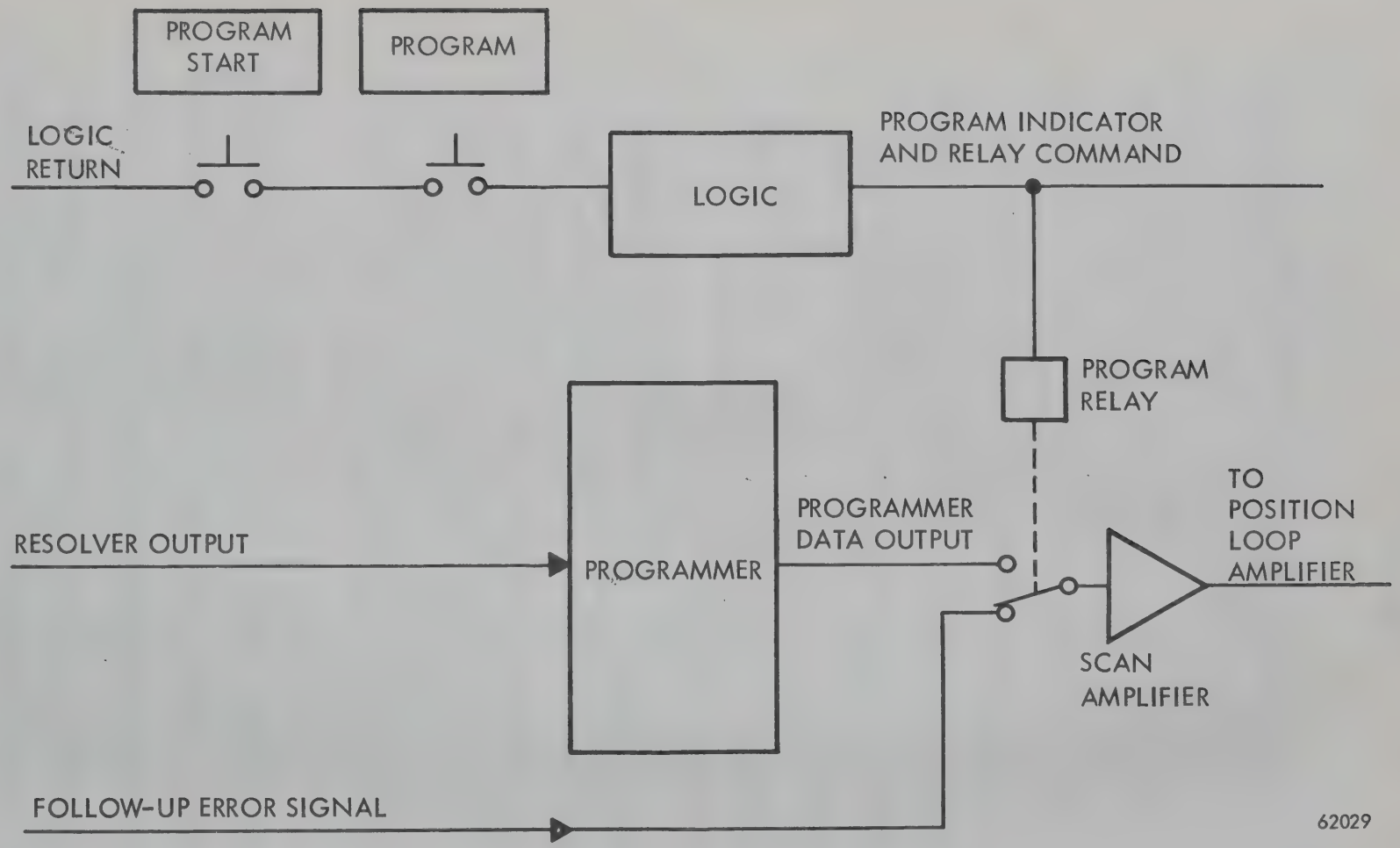


Figure 2-11. Program mode switching diagram

2-26. Antenna Control Subsystem Logic Analysis.

Most of the various commands described in the functional block diagram, with the notable exception of the slewing commands, are obtained by means of logic circuits. This paragraph provides logic analysis so that the status of the various control circuits may be thoroughly understood.

a. Logic Symbology. The logic symbology and truth table used in the logic diagram is shown in fig. 2-12, sheet 1. The logic diagram (fig. 2-12, sheets 2 and 3) shows that extensive use is made of Nand gates with input commands as logical 0's. Coincident logical one signals into the output gates result in logical 0 outputs to energize relay armatures. Logic analysis is based on operating procedure, beginning with a pre-standby mode with an interlock open to show the logic involved in antenna drive inhibit. This is followed by a brief description of the standby mode which is simply the pre-standby mode in terms of antenna motion but with all interlocks closed and the subsystem ready for operation. The logic involved in actual operation of the antenna is then begun in the manual mode with handwheel positioning only which is succeeded by the various manual modes. Finally a complete acquisition mode is described. The text for each of the modes is supplemented by logic tabulation which shows only the changes from manual brought about by the different modes of operation. The chart below shows the logic outputs in entirety for quick reference.

Logic Gate Outputs

GATE	Manual (handwheel positioning)	Manual (rate augment)	Manual (slewing)	Manual (bar scan)	Acquisition to Auto track	Acquisition to Satellite Det	Acquisition to Phase Lock
D6	1	1	1	1	1	1	1
A6	0	0	0	0	0	0	0
B6	0	0	0	0	0	0	0
E5	1	1	1	1	1	1	1
D7	0	0	0	0	0	1	1
C6	0	0	0	0	0	1	1
F4	1	0	1	1	1	1	1
F6	0	0	1	1	1	1	1
M4	1	1	1	1	1	1	1
G4	0	1	1	0	0	1	1
F5	0	1	1	0	0	1	1
G5	1	1	1	0	0	1	1
H4	1	1	1	1	1	1	1
H5	1	1	0	1	1	0	1
J4	1	1	1	1	1	0	0
J5	1	1	1	1	1	0	1
J3A	0	0	0	0	0	1	0
J3B	0	0	0	0	0	1	1
J1-9	1	1	1	1	1	0	0
K5	1	1	1	1	1	1	0
K4	1	1	1	1	1	1	0
K6	1	1	1	1	0	0	1
M5	1	1	1	1	1	1	0
L5	1	1	1	1	1	1	1

b. Pre-standby (Interlock Open). An open in the pre-standby interlock circuit constitutes a pre-standby interlock command. The interlock circuit is both mechanically and electrically actuated. The MOUNT SAFE, EL STOW, LIMITS ELEC lamps are part of the mechanically actuated switch circuits which initiate relay switch functions.

(1) When the complete interlock circuit is closed, Nand gate D2A input is a logical 0 which places an enable on the standby flip-flop E1-E2. The flip-flop either sets or remains in the reset position with the E1 output a logical 0. The three command inputs shown into the E1 side are inhibit commands in the sense that if any one of the commands is present, the antenna is prevented from rotating and drive power is removed from the drive motor.

(2) A fault in the pre-standby interlock sets the flip-flop and the set side output opens relay driver B6. This is the most important function because this applies the antenna brakes and removes any drive power. The applicable ANTENNA STATUS interlock lamp or LIMITS ELEC lamp will light to indicate where the open is. It should be noted here that the electrical limits interlock is the only one which may normally be closed by a control panel operation; the others must be closed by maintenance procedure. Note also that since the standby flip-flop provides primary mode control

b. Pre-standby (Interlock Open). (Contd)

Gate	Logical Output	Function Initiated	Display or End Result Observed
D6	0	Console lamp control relay deenergized.	Console MODE CONTROL lamps and BEACON RECEIVER lamps inhibited.
A6	1	Rate and limit relay deenergized.	AZIMUTH ELEC LIMITS or ELEVATION ELEC LIMITS lamp is on if condition exists.
B6	1	(B1-10) output deenergizes not standby follower relay, which deenergizes brake solenoid relays. (C19-8) output deenergizes standby feedback relay.	Antenna brakes applied. AZ BRAKE, EL BRAKES, ANTENNA DRIVE, EL STOW, MOUNT SAFE, or OVERLOAD lamps are on as applicable. (EL STOW and MOUNT SAFE lamps require no logic function.) Power amplifier output is fed back to position loop amplifier input.
E5	1	Return to STANDBY lamp is opened.	STANDBY lamp is off.*
D7	1	Handwheel clutch solenoids are deenergized.	Handwheel positioning is disabled.
C6	1	Return to MANUAL lamp is opened.	MANUAL lamp is off.*
F4	1	Rate augment relay is deenergized, partially closing instrument servo electrical loop. Return to RATE AUG lamp is opened.	Rate augment is disabled. RATE AUG lamp is off.*
F6 A&B	1	Followup resolver transfer relay is deenergized.	Resolver output is connected to followup loop.
M4	1	Followup relay is deenergized.	Resolver output is connected to followup loop.
G4	1	Azimuth followup brake solenoid is deenergized.	Followup loop is complete, permitting followup to respond to antenna positioning.
F5	1	Elevation followup brake solenoid is deenergized.	Followup loop is complete, permitting followup to respond to antenna positioning.
G5	1	Bar scan relay is deenergized, return to BAR SCAN lamp is opened.	Scan generator input to scan amplifier is disabled. BAR SCAN lamp is off.*
H4	1	Program relay is deenergized, PROGRAM lamp return is opened.	Programmer input to scan amplifier is disabled. PROGRAM lamp is off.*
H5	1	Position amplifier caging relay is deenergized.	Position amplifier is uncaged to permit response to standby feedback volts.
J4	1	SIGNAL DETECT lamp return is opened.	SIGNAL DETECT lamp is off.*
J5	1	POSITION MEMORY lamp return is opened.	POSITION MEMORY lamp is off.*
J3 A	0	Solid state relay is closed.	Output of position memory is shunted to ground.
J3 B	0	Solid state relay is closed.	Data from tachs is shunted to ground.
J1-9	1	Solid state relay is opened.	Position memory amplifier output is fedback. (Amplifier is caged.)
K5	1	PHASE LOCK lamp return is opened.	PHASE LOCK lamp is off.*
K4	1	AUTOTRACK lamp return is opened.	AUTOTRACK lamp is off.*
K6	1	ACQUISITION lamp return is opened.	ACQUISITION lamp is off.*
M5	1	Track relay is deenergized.	Output of scan amplifier is fed to position amplifier.
L5	1	FORCED TRACK lamp return is opened.	FORCED TRACK lamp is off.*

* These lamps are inhibited by output of D6.

of the entire subsystem, the pre-standby input should be an enabling logical 1. Operation of the affected relays for the pre-standby mode is tabulated below.

c. Standby. The logic shows that pressing the MODE CONTROL STANDBY switch initiates the same functions as the pre-standby except that the MODE CONTROL lamps are not inhibited, and the STANDBY lamp will light. The standby mode must be attained before any operational mode may be selected. Initial standby is attained by the differentiating circuit through terminal 1 of E1.

d. Manual. With the exception of the program mode, all modes of operation are either basically manual or must be preceded by the manual mode. The key to this is evident in the logic diagram by noting that the mode control flip-flops can be reset only by the PROGRAM switch or one of the manual modes. Since the autotrack and forced track commands do not generate a reset command, the standby flip-flop would stay in the standby mode if an attempt was made to select either of these modes from standby.

(1) Handwheel Positioning. Pressing the MODE CONTROL MANUAL switch generates a reset of the control flip-flops. Note that this differs from the other mode commands in that the command is actually a reset command for all the control flip-flops. In any one of the other modes the applicable control flip-flop is set and the remaining flip-flop reset. The logical outputs resulting from a manual command are tabulated below.

d. Manual. (Contd)

Gate	Logical Output	Function Initiated	Display or End Result Observed
		HANDWHEEL ONLY	
D6	1	Console lamp indicator control relay energized. MODE CONTROL and BEACON RECEIVER indicator lamps enabled to function according to operation.	
A6	0	Energizes rate and servo limit relay to connect servo limit backout volts when servo limit is exceeded	SERVO indicator lamp lights when limits are exceeded. Antenna will back out of limit.
B6	0	Not-standby follower relay energized; antenna brakes solenoid control relay is energized. Standby feedback voltage relay is energized.	Antenna brakes released. AZ BRAKE and EL BRAKE lamp indicators go off. Followup loop is applied to position loop; antenna positions according to error signal.
E5	1	Signal return to STANDBY lamp indicator is opened.	STANDBY lamp indicator is off.
D7	0	Handwheel clutch solenoids are energized.	Handwheel positioning is enabled.
C6	0	Signal return to MANUAL lamp indicator is closed.	MANUAL lamp indicator lights.
F4	1	Rate augment relay is deenergized, partially closing instrument servo electrical loop. Return to RATE AUG lamp indicator is opened.	RATE AUG indicator is off.
F6	0	Followup resolver transfer relay is energized.	Resolver output is connected to position loop amplifier via scanning amplifier.
M4	1	Followup relay is deenergized.	Followup amplifier input is made available for rate augment or resolver output.
G4	0	Azimuth followup brake solenoid relay is energized.	Positioning of resolver rotor by followup loop is disabled.
F5	0	Elevation followup brake solenoid relay energized.	Positioning of resolver rotor by followup loop is disabled.
G5	1	Bar scan relay is deenergized. BAR SCAN lamp indicator return is opened.	Scan input is removed from position loop amplifier input. BAR SCAN lamp indicator goes off.
H4	1	Program relay is deenergized. PROGRAM indicator return is opened.	Program output is removed from error phase demodulator input. PROGRAM lamp indicator is off.
H5	1	Position amplifier caging relay is deenergized.	Position amplifier responds to error signal or standby feedback voltage.
J4	1	Return to SIGNAL DETECT lamp indicator is opened.	SIGNAL DETECT lamp indicator is off.
J5	1	POSITION MEMORY lamp indicator return is opened.	POSITION MEMORY lamp indicator is off.
J3 A	0	Solid state relay is closed.	Output of position memory is shunted to ground.
J3 B	0	Solid state relay is closed.	Data from tachs is shunted to ground.
J1	1	Solid state relay is opened.	Position memory amplifier feedback is fedback (amplifier is caged).
K5	1	Indicator lamp return is opened.	PHASE LOCK indicator lamp is off.
K4	1	Indicator lamp return is opened.	AUTOTRACK switch indicator lamp is off.
K6	1	Indicator lamp return is opened.	ACQUISITION switch indicator lamp is off.
M5	1	Track relay is deenergized.	Output of scan summing amplifier is fed into position amplifier instead of beacon receiver error signal.
L5	1	Indicator lamp return is opened.	FORCED TRACK indicator lamp is off.

d. Manual. (Contd)

Gate	Logical Output	Function Initiated	Display or End Result Observed
		RATE AUGMENT	
D6			
A6			
B6			
F5			
D7			
C6			
F4	0	Rate augment relay is energized, RATE AUG lamp return is closed.	Output of rate augment potentiometers is fed to followup, RATE AUG lamp is on.
F6			
M4			
G4	1	Azimuth followup brakes deenergized.	Gear train locked. Antenna moves according to rate augment potentiometer output.
F5	1	Elevation followup brakes deenergized.	Gear train locked. Antenna moves according to rate augment potentiometer output.
G5			
H4			
H5			
J4			
J5			
J3 A			
J3 B			
J1			
K5			
K4			
K6			
M5			
L5			
		SLEWING	
D6			
A6			
B6			
F5			
D7			
C6			
F4			
F6	1	Resolver transfer relay is deenergized.	Resolver output is applied to followup loop.
M4			
G4	1	Azimuth followup brake solenoid deenergized.	Azimuth followup brakes release
F5	1	Elevation Followup brake solenoid deenergized.	Elevation followup brakes release

d. Manual. (Contd)

Gate	Logical Output	Function Initiated	Display or End Result Observed
		SLEWING (Contd)	
G5			
H4			
H5	0	Caging relay is energized.	Position amplifier is caged; not affected by error voltage.
J4			
J5			
J3 A			
J3 B			
J1			
K5			
K4			
K6			
M5			
L5			
		BAR SCAN	
D6			
A6			
B6			
E5			
D7			
F4			
F6	1	Resolver transfer relay is deenergized.	Resolver output is applied to followup.
M4			
G4			
F5			
G5	0	Scan relay is energized, BAR SCAN return is closed.	Scan generator output is fed to position loop, BAR SCAN indicator is on.
H4			
H5			
J4			
J5			
J3 A			
J3 B			
J1			
K5			
K4			
K6			
M5			
L5			

d. Manual. (Contd)

Gate	Logical Output	Function Initiated	Display or End Result Observed
		BAR SCAN WITH AUTO TRACK	
D6			
A6			
B6			
F5			
D7			
C6			
F4			
F6	1	Resolver transfer relay is deenergized.	Resolver output is applied to followup.
M4			
G4			
F5			
G5	0	Scan relay is energized, BAR SCAN return is closed.	Scan generator output is fed to position loop, BAR SCAN indicator is on.
H4			
H5			
J4			
J5			
J3 A			
J3 B			
J1			
K5			
K4			
K6	0	ACQUISITION lamp return is closed.	ACQUISITION lamp is on.
M5			
L5			
		BAR SCAN, AUTO TRACK, AND SATELLITE DETECT	
D6			
A6			
B6			
E5			
D7	1	Handwheel clutch solenoids are deenergized.	Handwheel positioning is disabled.
C6	1	MANUAL lamp return is opened.	MANUAL lamp is off.
F4			
F6	1	Followup resolver transfer relay is deenergized.	Resolver output is fed to followup.
M4			
G4	1	Azimuth followup brake solenoid is deenergized.	Azimuth followup brakes release, allowing followup to provide digital readout of antenna position.
F5	1	Elevation followup brake solenoid is deenergized.	Elevation followup brakes release, allowing followup to provide digital readout of antenna position.

Gate	Logical Output	Function Initiated	Display or End Result Observed
		BAR SCAN, AUTO TRACK, AND SATELLITE DETECT (Contd)	
G5			
H4			
H5	0	Position amplifier relay is energized.	Position amplifier is caged, so output will not affect position memory input to tach loop.
J4	0	SIGNAL DETECT lamp return is closed.	SIGNAL DETECT lamp is on.
J5	0	POSITION MEMORY lamp return is closed.	POSITION MEMORY lamp is on.
J3 A	1	Position memory switch is opened.	Output of position memory is fed to tach loop.
J3 B	1	Position memory integrate switch is opened.	Tach output is fed to position memory.
J1	0	Position memory not-integrate switch is closed.	Position memory caging is removed.
K5			
K4			
K6	0	ACQUISITION lamp return is closed.	ACQUISITION lamp is on.
M5			
L5			
		PHASE LOCK	
D6			
A6			
B6			
E5			
D7	1	Handwheel clutch solenoids are deenergized.	Handwheel positioning is disabled.
C6	1	MANUAL lamp return is opened.	MANUAL lamp is off.
F4			
F6	1	Followup resolver transfer relay is deenergized.	Resolver output is fed to followup.
M4			
G4	1	Azimuth followup brake solenoid is deenergized.	Azimuth followup brakes release, allowing followup to provide digital readout of antenna position.
F5	1	Elevation followup brake solenoid is deenergized.	Elevation followup brakes release, allowing followup to provide digital readout of antenna position.
G5			
H4			
H5			
J4	0	SIGNAL DETECT lamp return is closed.	SIGNAL DETECT lamp is on.
J5			
J3 A			
J3 B	1	Position memory integrate switch is opened.	Tach output is fed to position memory.
J1	0	Position memory not-integrate switch is closed.	Position memory caging is removed.
K5	0	PHASE LOCK lamp return is closed.	PHASE LOCK lamp is on.
K4	0	AUTO TRACK lamp return is closed.	AUTO TRACK lamp is on.
K6	1	ACQUISITION lamp return is open.	ACQUISITION lamp is off.
M5 L5	0	Track relay is energized.	Tracking error signal is fed to position amplifier.

(2) Rate Augment. Pressing the MODE CONTROL RATE AUG switch results in logic which is basically the same as in the manual handwheel positioning mode except that the followup brakes are released, and the rate augment potentiometer output drives the resolver control transformer rotor at a constant rate as selected by the operator. Since the clutch logic is unchanged the handwheel positioning is still effective. Logic changes from handwheel positioning are tabulated above (par. d).

(3) Slewing. Moving the SLEW potentiometers from the detent position generates a command which connects the SLEW potentiometer arm output into the tach loop. The resolver control transformer followup loop is closed so that the rotor may follow the antenna to indicate instantaneous position. Logic changes from handwheel positioning are tabulated above (par. d).

(4) Bar Scan. This mode of operation is normally used prior to acquisition. Acquisition of a satellite is normally an integration of this form of manual operation, autotrack, satellite detect, and phase lock. The next paragraph describes the logic used in bar scan as part of acquisition.

e. Acquisition. Acquisition of a satellite is obtained as a result of multiple modes of operation. Normally acquisition will occur with the autotrack mode imposed on bar scanning. Pressing the MODE CONTROL BAR SCAN switch resets all the mode control flip-flops except the bar scan flip-flop which is set by the generated command. The resulting logic outputs are such that the bar scan generators are connected into the position loop. The antenna will scan according to the

BAR SCAN CONTROL settings. The BAR SCAN CONTROL portion of the antenna console is not associated with logic circuitry but is used in conjunction with the MODE CONTROL BAR SCAN mode of operation which is logic circuitry. The logic outputs which differ from handwheel positioning are tabulated above (par. d). If the MODE CONTROL ACQUISITION/AUTOTRACK switch is then pressed, the system goes into acquisition mode and certain logic is enabled. This is shown in the tabulation for bar scan with autotrack. Typically, at some time during the scan a satellite detect signal will be received at this time MODE CONTROL ACQUISITION lamp lights. Dual Nand gate J1 through Nand gate J2 then enables the position memory which will return the antenna to the point of signal detect. The logic outputs for this function are tabulated in the bar scan, autotrack, and satellite detect functions below. When acquisition occurs, the AUTOTRACK lamp goes on and the ACQUISITION lamp goes off. When the phase lock command is received the subsystem then goes into actual autotracking and BEACON RECEIVER PHASE LOCK lamp lights. Resulting logic change from handwheel positioning is tabulated above (par. d).

f. Followup Disable. The SUPPLEMENTAL CONTROL FOLLOWUP DISABLE switch is used in the handover technique. The handover technique is primarily used as a time saving device. By pressing the SUPPLEMENTAL CONTROL FOLLOWUP DISABLE switch the antenna will continue autotracking an already-acquired satellite, and the digital indicator may be hand-positioned to the vicinity of a known new satellite. The next paragraph describes the function and paragraph (2) below explains the primary logic involved.

(1) While autotracking a satellite the digital indicator provides an instantaneous indication of the antenna position through the gear train to the resolver control transformer. Pressing the SUPPLEMENTAL CONTROL FOLLOWUP DISABLE switch permits use of the handwheel positioning control in the same manner as described in paragraph d (1) above except that the antenna at this time will not position to the setting commanded by the handwheel. Only the digital position indicator will respond to the command. Loss of phase lock, or pressing the MODE CONTROL MANUAL switch then causes the antenna to move to the commanded position.

(2) The key to the logic analysis is the followup disable control flip-flop M2. During autotrack the flip-flop is in the reset state as a result of the mode reset command to terminal 3. The set side of the flip-flop is prevented from receiving a triggering input as a result of an inhibited Nand gate M1A. The inhibit is a logical 1 followup disable input into M3B which is then applied as a logical 0 to M1A input. The other input to Nand gate M1A is an enable obtained from phase lock command through Nand gates K2 and M1B. During tracking at the time that the SUPPLEMENTAL CONTROL FOLLOWUP DISABLE switch is pressed, the inhibit input becomes an enable and the resulting gate output triggers the flip-flop to the set state. The output of the flip-flop then lights the FOLLOWUP DISABLE lamp and energizes the followup disable relay. This action

opens the followup loop, gate D7 engages the handwheel positioning controls, and gates G4 and F5 apply the followup brakes. Positioning of the handwheels then drives the digital indicator to the desired point of intercept with the new satellite. The function of Nand gate M3 is to generate a return-to-manual command on loss of phase lock after the SUPPLEMENTAL CONTROL FOLLOWUP DISABLE switch is pressed to place an enabling 1 on terminal 2. Upon loss of phase lock, the phase lock command changes from a logical 0 to 1 which results in an enable from Nand gate K2 applied to Nand gate M3A. Flip-flop M2A and the forced track flip-flop outputs are also enables. The output of Nand gate M3 is then used to generate a reset of all the control flip-flops.

g. Program. Pressing the MODE CONTROL PROGRAM switch after pressing the SUPPLEMENTAL CONTROL PROGRAM START switch sets the program control flip-flop H1. This effectively results in relay driver H4 output energizing the program relay which connects the programmer output data as the position loop amplifier driving signal. The programmer input is in shunt with the resolver control transformer input and therefore receives antenna position data.

h. Forced Track. Pressing any one of the MODE CONTROL operating mode switches except AUTOTRACK or FORCED TRACK resets the mode control flip-flops and takes the subsystem out of standby. It is then possible to go into the forced track mode by pressing the MODE CONTROL FORCED TRACK switch. This operation sets the forced track flip-flop L3 which initiates three important functions.

The signal source select relay energizes and connects the envelope detector output of the Beacon demodulator to the Antenna Control Subsystem; the second function is an inhibit placed on Nand gates E4, F2, G2 and H2; the third function is the energizing of the track/scan relay into the track position to connect the Beacon Receiver error signal into the position loop amplifier. All other antenna positioning capabilities except slewing are inhibited. The net result is that the antenna will remain stationary in the absence of a signal from the Beacon Receiver (discounting noise effects). Since the Beacon demodulator is dependent on the antenna position for its signal input and subsequent output signal to the Antenna Control Subsystem, a tracking loss sustained for any period of time permits the satellite to escape from the antenna beamwidth, and the satellite is permanently lost. The only alternative is to go into a manual search mode to reacquire.

i. Pencil Beam. The pencil beam mode may be used when it is not desirable to use the SUPPLEMENTAL CONTROL NORMAL function during search. In this mode the pseudo monopulse tracking is disabled. Acquisition and tracking is subsequently performed on the basis of the SIGNAL STRENGTH meter readings. The logical functions which result from pressing the SUPPLEMENTAL CONTROL PENCIL BEAM switch inhibits both autotrack and forced track. This is evident in the logic by the status of Nand gates K2A and K3B. The inhibit on these gates provided by the pencil beam command opens relay driver M5 which keeps the track/scan relay connected at all times to the scan amplifier output.

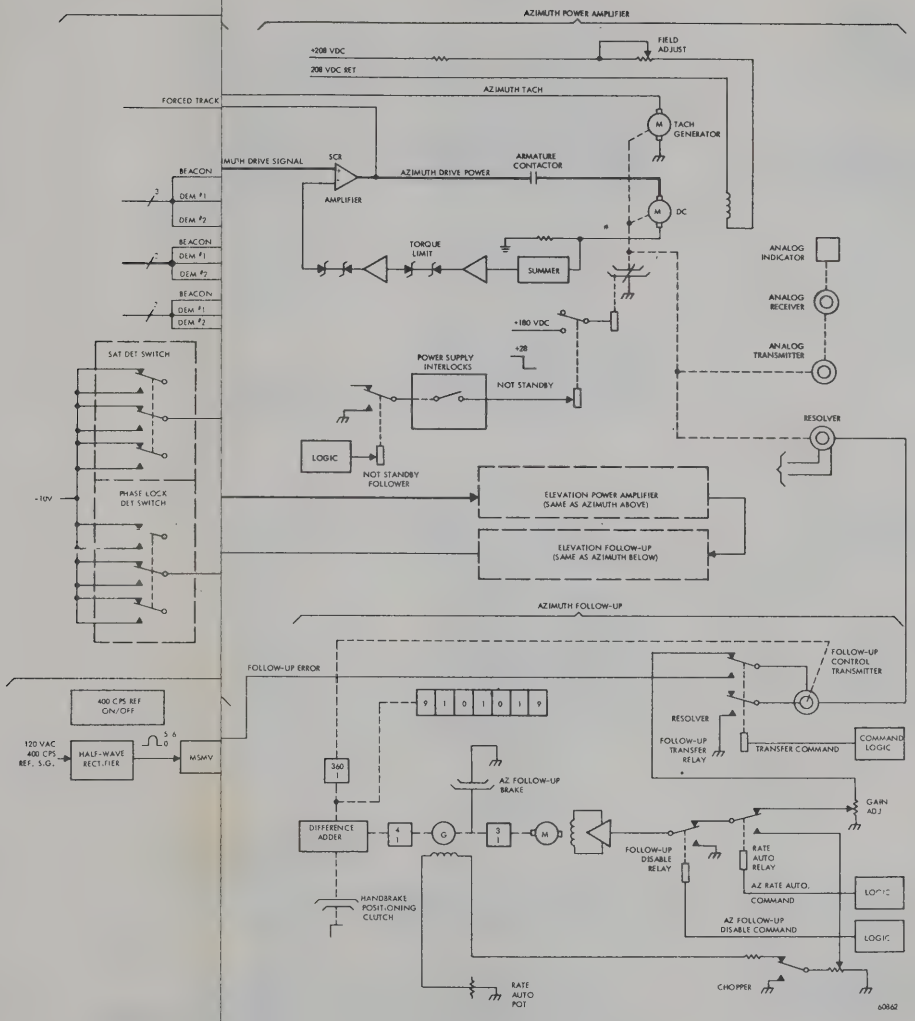
j. Loss of Track Logic. Previous analysis of the followup disable mode (par. f.) showed that the Antenna Control Subsystem would return to the manual mode of operation if the phase lock was lost while in followup disable. This is a normal operation in which it is desired to acquire a new satellite upon loss of phase lock and no attempt normally would be made to reacquire the tracked satellite. The possibility arises, however, that due to signal conditions or other factors the phase lock is lost and it is desired to reacquire the same satellite. If the SUPPLEMENTAL CONTROL FOLLOWUP DISABLE switch had not been operated the subsystem would revert to the mode which existed prior to acquisition. The logical basis for this is that the state of the control flip-flops is not dependent on phase lock logic. Therefore, if phase lock is lost, the resulting output logic would merely revert to the logic present prior to the loss of phase lock.

k. Reference Generator Detailed Logic Analysis. The input signal consists of unfiltered half wave rectified 400 cps voltage into Nand gate 1A1-A. The resulting output is square wave at a 100 pps rate. The two stage counter 1A2 and 1A3 divides the frequency by four to develop 100 pps. These pulses are used as the trigger for the three-stage shift register 1B1, 1B2, and 1B3. If the two-stage counter output is considered as the clock output with a 50/50 duty cycle, the shift register, Nand gate 1A1-B, and inverting buffer 1C1-A functions as a ring counter.

(1) When the set side outputs of the shift register are all logical 1's Nand gate is enabled with a logical 0 steer input and logical 1 clear input to flip-flop 1B1. The clock signal will switch the flip-flop and A1 output

will drop from +5 volts to 0 simultaneously with A2 output rising to +5 volts. Switching the flip-flop places an inhibit on the Nand gate until coincident inputs are again obtained. This accounts for the 30 ms time at 0 volts on the output waveforms. The next clock pulse again triggers flip-flop 1B1 and also 1B2. Flip-flop 1B1 remains in this state until Nand gate coincidence. Similarly the other two flip-flops will switch and remain inhibited until the steer inputs change. The resultant outputs are 10 ms pulses at a repetition rate of 25 pps which is the scanning frequency.

(2) The pulses developed for the phase demodulator are generated in the same manner as described above except for delaying the trigger pulse by a fixed amount dependent on the values of capacitors C3 and C4.



ntrol subsystem functional block diagram

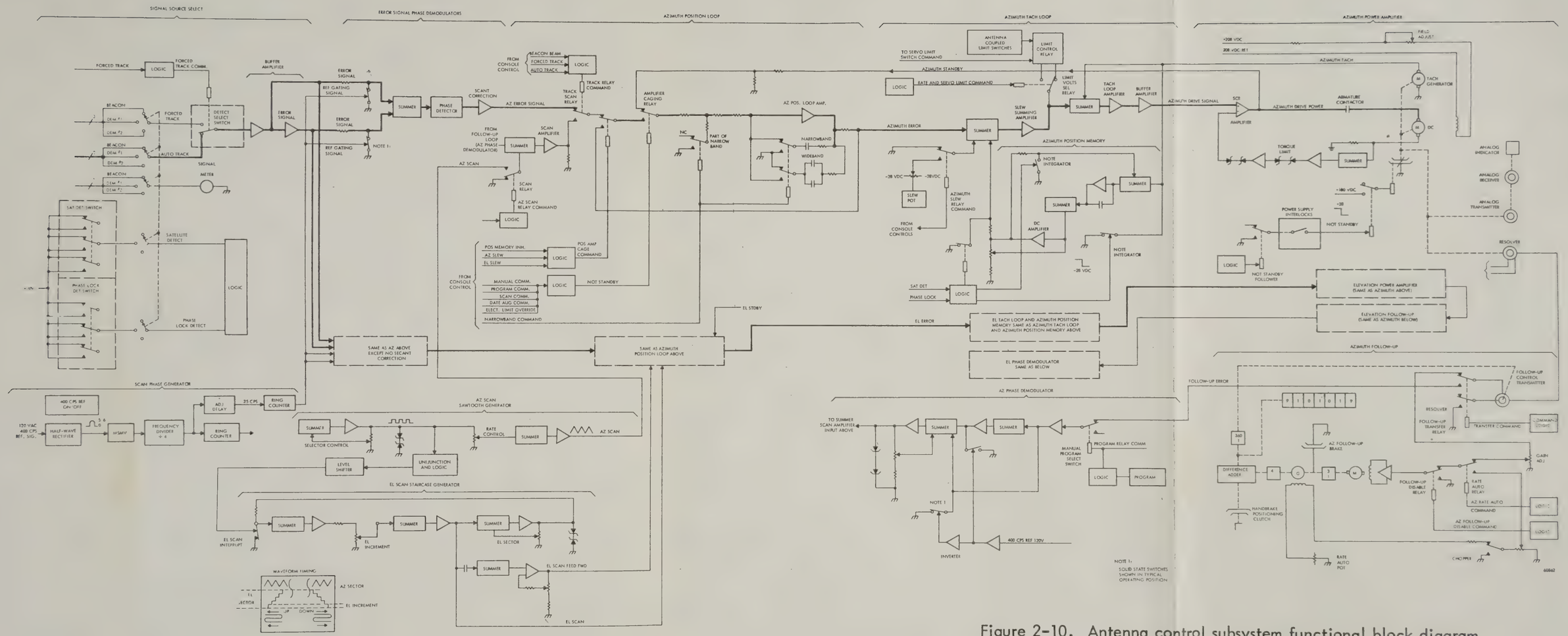


Figure 2-10. Antenna control subsystem functional block diagram

NOTES:

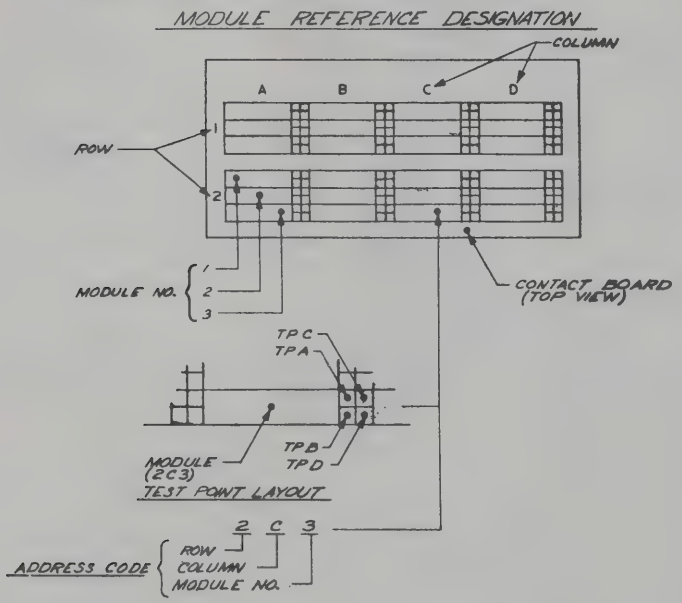
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NO. OR SUB-ASS'Y DESIGNATION(S).

4. MODULES AND THEIR LOGIC FUNCTIONS ARE DESCRIBED BELOW. NOTE THAT SYMBOLS ON THE LOGIC DIAGRAMS REPRESENT THE FUNCTION PERFORMED AND THEREFORE MAY NOT CORRESPOND EXACTLY TO THE SYMBOLS IN THE MODULE UNITS BELOW.

5. POWER CONNECTIONS FOR ALL MODULES:
   PIN 1 – +5 VOLTS D.C.
   PIN 7 – +5 VOLTS D.C. RETURN
   (SIGNAL COMMON)

6. DASHED LINES IDENTIFY MODULE ENVELOPE WHEN A MODULE CONTAINS MORE THAN ONE LOGIC CIRCUIT.

7. THE DELAYED PULSE GROUP B1, B2, B3, AND B4, HAS THE SAME AMPLITUDE AND PHASE AS THE PULSE GROUP A1, A2, A3, AND A4, RESPECTIVELY. THE PHASE DIFFERENCE BETWEEN THESE TWO GROUPS OF PULSES IS DEPENDENT ON THE VALUES OF CAPACITORS C3, AND C4.



NOTE:

8. MODULES ARE LOCATED ON THE CONTACT BOARD ACCORDING TO THE SCHEME ABOVE. FOR EACH ROW AND COLUMN DESIGNATION A MODULE IS FURTHER IDENTIFIED BY MODULE 1, 2, OR 3.

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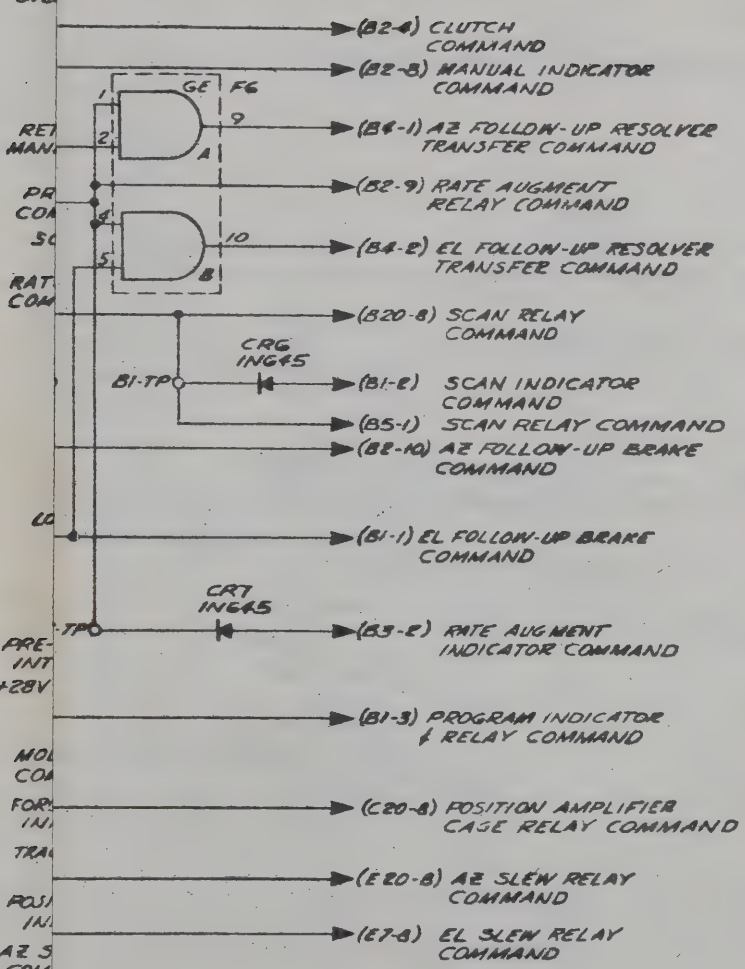
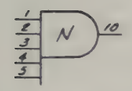
igure 2-12. Antenna control subsystem logic diagram (sheet 1 of 4)



gure 2-12. Antenna control subsystem logic diagram (sheet 2 of 4)

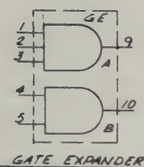


NAND

PIN NO.	INPUT 1	2	3	4	5	OUTPUT 10
	1	1	1	1	1	0
	0	1	1	1	1	1
	1	0	1	1	1	1
	0	0	1	1	1	1
	1	1	0	1	1	1
	0	1	0	1	1	1
	1	0	0	1	1	1
	0	0	0	1	1	1
	1	1	1	0	1	1
	0	1	1	0	1	1
	1	0	1	0	1	1
	0	0	1	0	1	1
	1	1	0	0	1	1
	0	1	0	0	1	1
	1	0	0	0	1	1
	0	0	0	0	1	1
	1	1	1	1	0	1
	0	1	1	1	0	1
	1	0	1	1	0	1
	0	0	1	1	0	1
	1	1	0	1	0	1
	0	1	0	1	0	1
	1	0	0	1	0	1
	0	0	0	1	0	1
	1	1	1	0	0	1
	0	1	1	0	0	1
	1	0	1	0	0	1
	0	0	1	0	0	1
	1	1	0	0	0	1
	0	1	0	0	0	1
	1	0	0	0	0	1
	0	0	0	0	0	1

NAND DRIVER

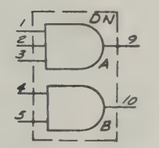
PIN NO.	INPUT 1	OUTPUT 10
	1	1
	0	0



GATE EXPANDER

A PIN NO. 1	INPUT 2	3	OUTPUT 9
1	1	1	1
0	1	1	0
1	0	1	0
0	0	1	0
1	1	0	0
0	1	0	0
1	0	0	0
0	0	0	0

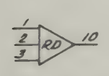
B PIN NO. 4	INPUT 5	OUTPUT 10
1	1	1
0	1	0
1	0	0
0	0	0



DUAL NAND

A PIN NO. 1	INPUT 2	3	OUTPUT 9
1	1	1	0
0	1	1	1
1	0	1	1
0	0	1	1
1	1	0	1
0	1	0	1
1	0	0	1
0	0	0	1

B PIN NO. 4	INPUT 5	OUTPUT 10
1	1	0
0	1	1
1	0	1
0	0	1



RELAY DRIVER

PIN NO.	INPUT 1	2	3	OUTPUT 10
	1	1	1	1
	0	1	1	0
	1	0	1	0
	0	0	1	0
	1	1	0	0
	0	1	0	0
	1	0	0	0
	0	0	0	0

4 INPUT NAND GATE (NAND-2)

REF. (SM-A-369801)

PIN CONNECTIONS

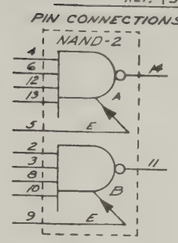


TABLE OF COMBINATIONS

	INPUT 4	6	12	13	OUTPUT 14
CIRCUIT A:					
CIRCUIT B:	2	3	8	10	11
	L	L	L	L	H
	L	L	L	H	H
	L	L	H	L	H
	L	L	H	H	H
	L	H	L	L	H
	L	H	L	H	H
	L	H	H	L	H
	L	H	H	H	H
	H	L	L	L	H
	H	L	L	H	H
	H	L	H	L	H
	H	L	H	H	H
	H	H	L	L	H
	H	H	L	H	H
	H	H	H	L	H
	H	H	H	H	L

THE BUFF-2 MODULE USES THE NAND-2 MODULE TABLE OF COMBINATIONS (PIN CONNECTIONS ARE IDENTICAL).

4 INPUT BUFFER GATE (BUFF-2)

REF. (SM-A-369804)

PIN CONNECTIONS

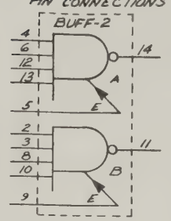
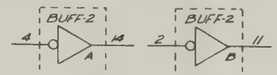


TABLE OF COMBINATIONS

REFER TO THE TABLE OF COMBINATIONS FOR THE NAND-2 MODULE. (PIN CONNECTIONS ARE IDENTICAL.)



ALL BUFF-2 MODULE CIRCUITS ARE USED AS INVERTING BUFFER AMPLIFIERS. (SEE ABOVE)

CLOCKED JK FLIP-FLOP (FF)

REF. (SM-A-369802)

PIN CONNECTIONS

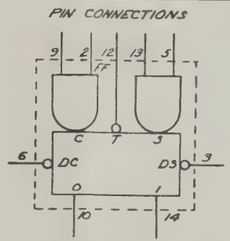


TABLE OF COMBINATIONS

INPUT * 5	2	OUTPUT 14	10
L	L	NO CHANGE	
L	H	L	H
H	L	H	L
H	H	UNDETERMINED	

* - SYNCHRONOUS ENTRY COINCIDENT WITH PULSE AT TRIGGER INPUT (PIN 12).

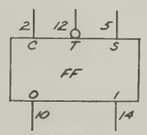


FIGURE 1

FLIP-FLOP LOGIC LEGEND

C - CLEAR STEER (INPUT)
T - TRIGGER
S - SET STEER (INPUT)
DC - DIRECT CLEAR
D3 - DIRECT SET

NOTE

1. THE CLOCKED FLIP-FLOP MODULE IS A DIRECT-COUPLED MASTER-SLAVE GATED FLIP-FLOP. INFORMATION AT THE INPUT STEERS IS TRANSFERRED TO THE MASTER FLIP-FLOP WHEN THE TRIGGER INPUT (PIN 12) IS "H". WHEN THE TRIGGER INPUT IS "L", THE INFORMATION IN THE MASTER IS TRANSFERRED TO THE SLAVE FLIP-FLOP.
2. SINCE ONLY SINGLE STEER INPUTS ARE USED IN THE SCAN GENERATOR CIRCUIT, THE SYMBOL IN FIGURE NO.1 IS USED THROUGHOUT.

3 INPUT NAND GATE (NAND-3)

REF. (SM-A-369803)

PIN CONNECTIONS

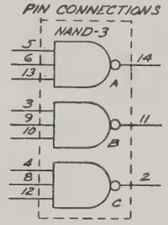


TABLE OF COMBINATIONS

	INPUT 5	6	13	OUTPUT 14
CIRCUIT A:				
CIRCUIT B:	3	9	10	11
CIRCUIT C:	4	8	12	2
	L	L	L	H
	L	L	H	H
	L	H	L	H
	L	H	H	H
	H	L	L	H
	H	L	H	H
	H	H	L	H
	H	H	H	L

4 INPUT NAND GATE (NAND-4)

REF (SM-A-369805)

PIN CONNECTIONS

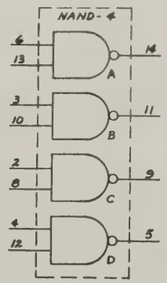


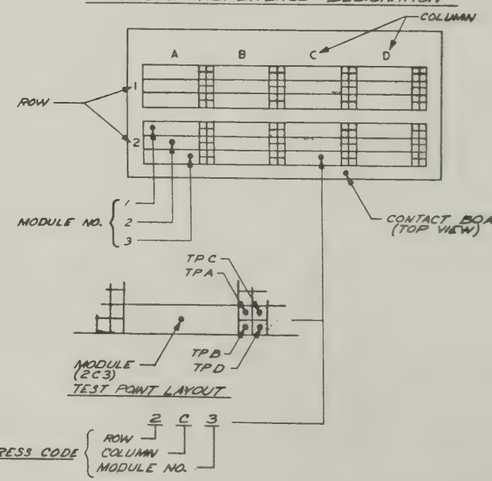
TABLE OF COMBINATIONS

	INPUT 6	13	OUTPUT 14
CIRCUIT A			
CIRCUIT B	3	10	11
CIRCUIT C	2	8	9
CIRCUIT D	4	12	5
	L	L	H
	L	H	H
	H	L	H
	H	H	L

NOTES:

3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NO. OR SUB-ASS'Y DESIGNATION(S).
4. MODULES AND THEIR LOGIC FUNCTIONS ARE DESCRIBED BELOW. NOTE THAT SYMBOLS ON THE LOGIC DIAGRAMS REPRESENT THE FUNCTION PERFORMED AND THEREFORE MAY NOT CORRESPOND EXACTLY TO THE SYMBOLS IN THE MODULE UNITS BELOW.
5. POWER CONNECTIONS FOR ALL MODULES:
   PIN 1 - +5 VOLTS D.C.
   PIN 7 - +5 VOLTS D.C. RETURN (SIGNAL COMMON)
6. DASHED LINES IDENTIFY MODULE ENVELOPE WHEN A MODULE CONTAINS MORE THAN ONE LOGIC CIRCUIT.
7. THE DELAYED PULSE GROUP B1, B2, B3, AND B4, HAS THE SAME AMPLITUDE AND PHASE AS THE PULSE GROUP A1, A2, A3, AND A4, RESPECTIVELY. THE PHASE DIFFERENCE BETWEEN THESE TWO GROUPS OF PULSES IS DEPENDENT ON THE VALUES OF CAPACITORS C3, AND C4.

MODULE REFERENCE DESIGNATION



NOTE:

8. MODULES ARE LOCATED ON THE CONTACT BOARD ACCORDING TO THE SCHEME ABOVE. FOR EACH ROW AND COLUMN DESIGNATION A MODULE IS FURTHER IDENTIFIED BY MODULE 1, 2, OR 3.

62758

Figure 2-12. Antenna control subsystem logic diagram (sheet 1 of 4)

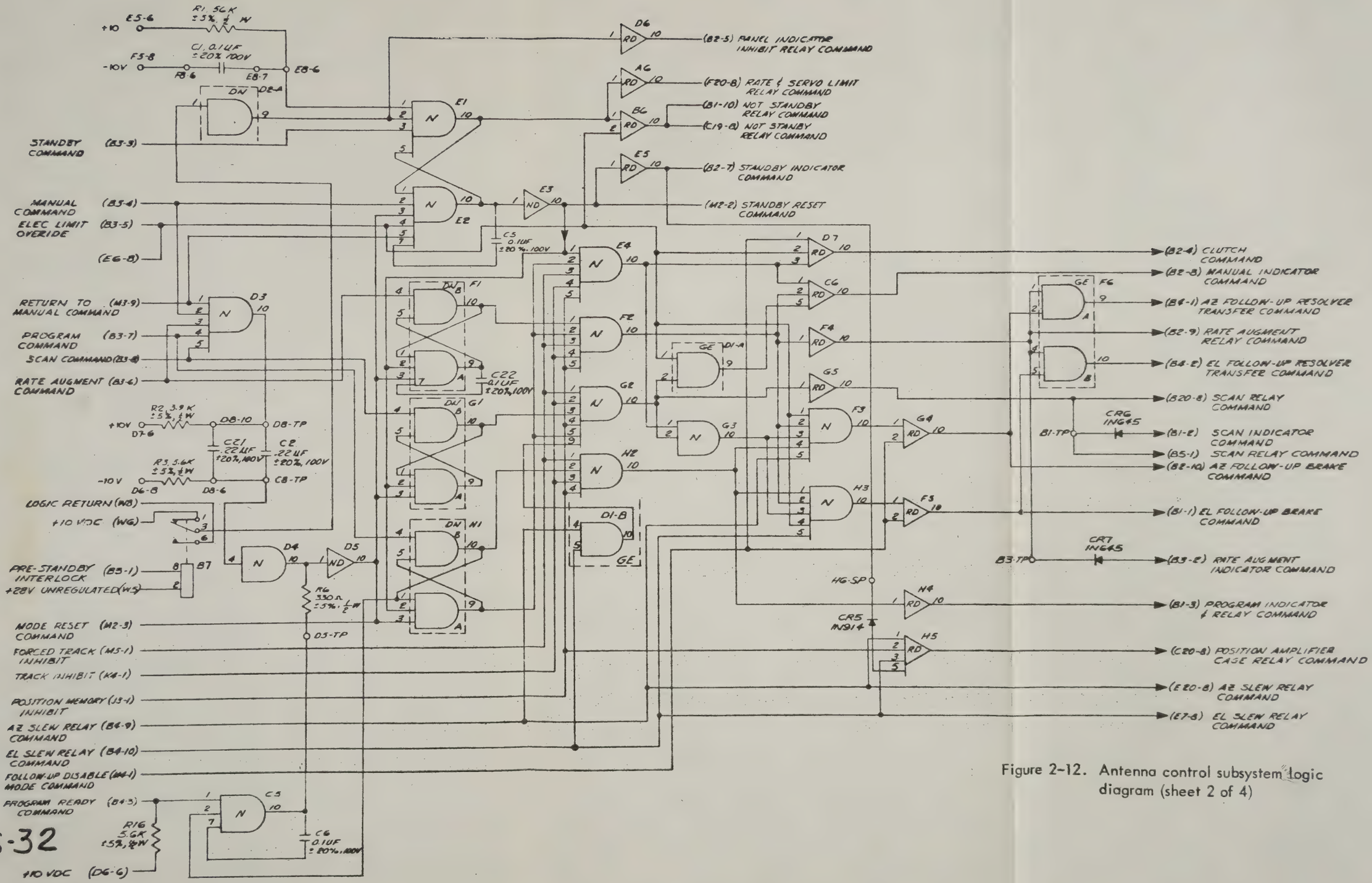


Figure 2-12. Antenna control subsystem logic diagram (sheet 2 of 4)

LOCK
OR COMMAND

TRACK INDICATOR
AND
INHIBIT

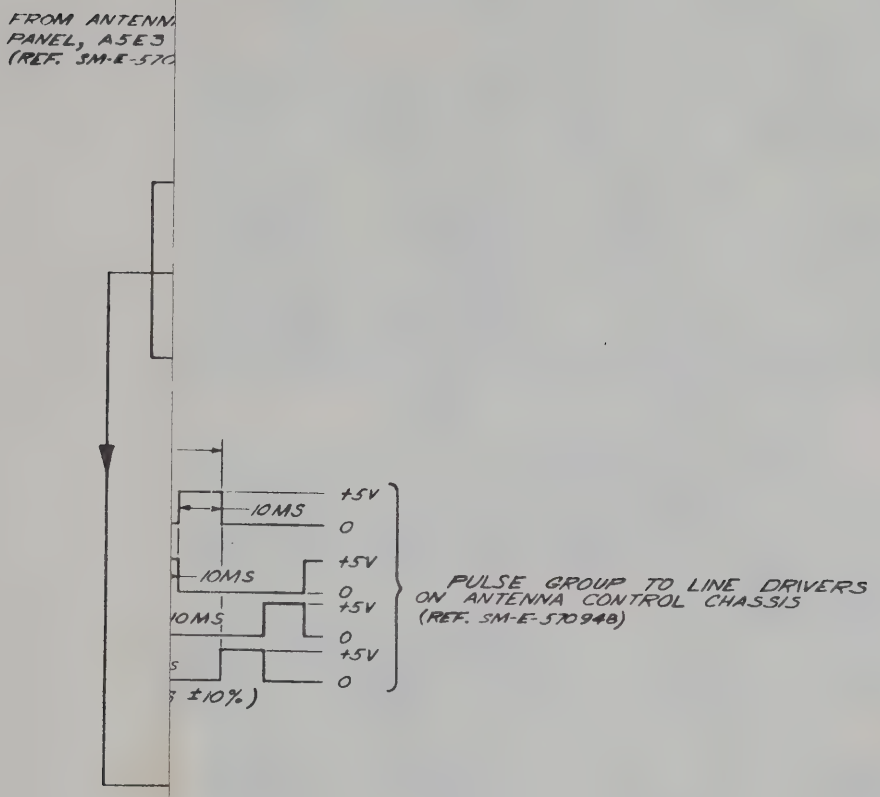
ION INDICATOR
AND
D TRACK
T
K RELAY
MAND

D TRACK INDICATOR
AY COMMAND

OW-UP DISABLE
COMMAND

OW-UP DISABLE RELAY
ICATOR COMMAND

ol subsystem logic
t 3 of 4)



LOGIC DIAGRAM, SCAN GENERATOR

62750

P.44(P3)

Figure 2-12. Antenna control subsystem logic diagram (sheet 4 of 4)

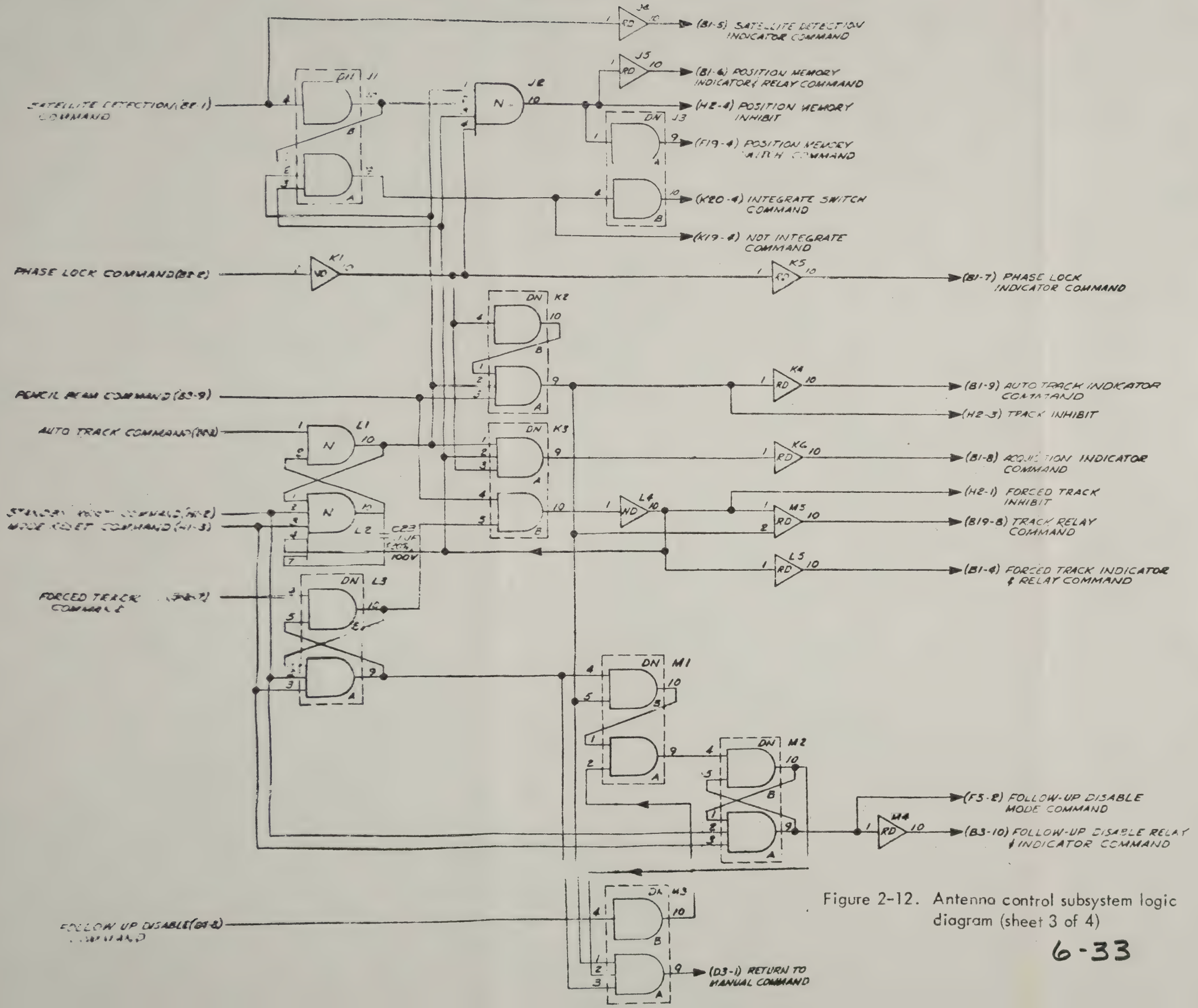
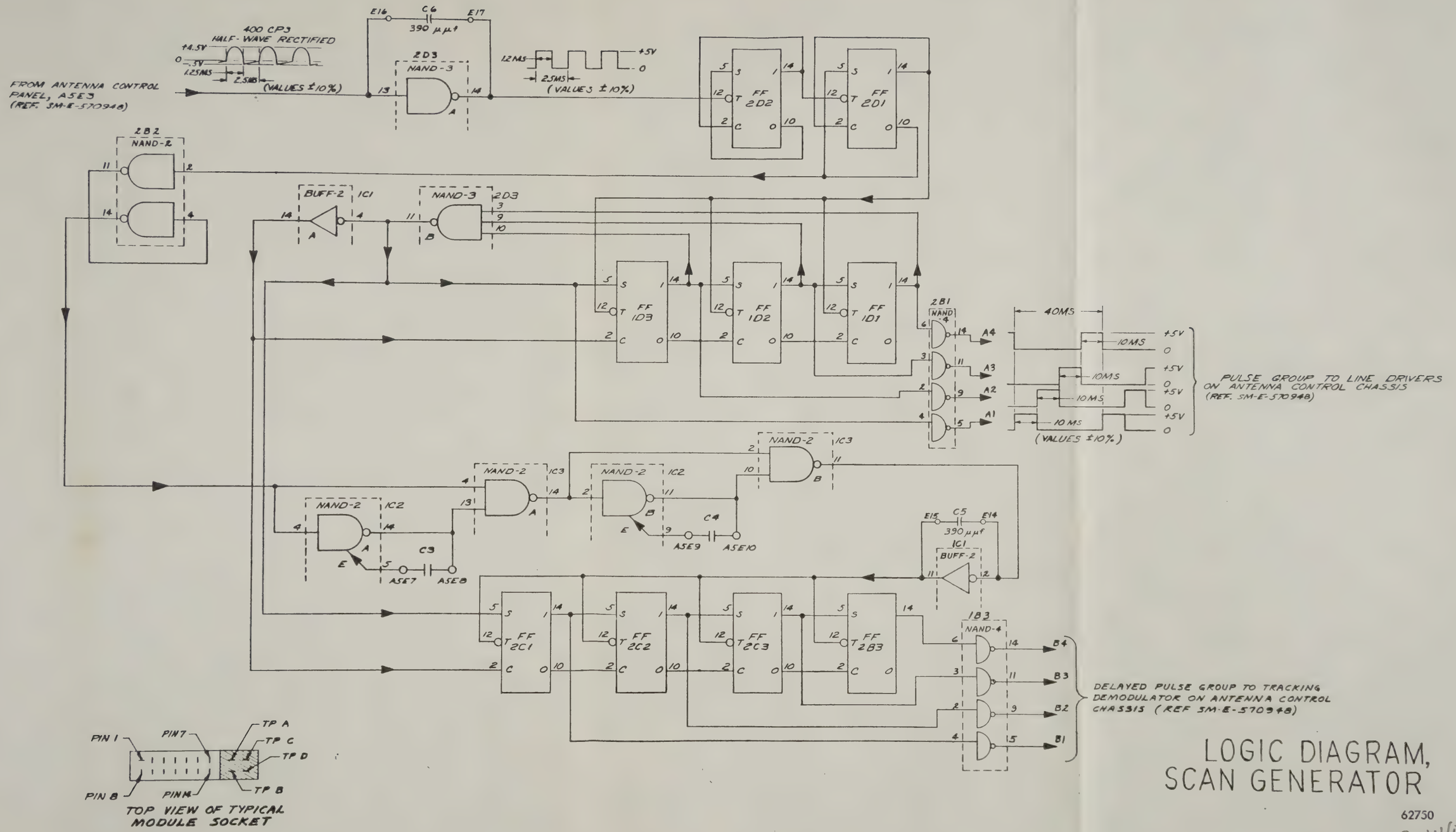


Figure 2-12. Antenna control subsystem logic diagram (sheet 3 of 4)



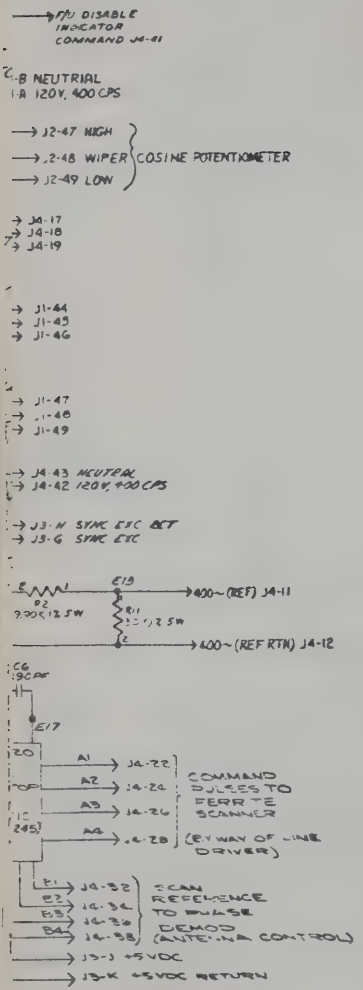
LOGIC DIAGRAM, SCAN GENERATOR

62750

P.44(P3)

Figure 2-12. Antenna control subsystem logic diagram (sheet 4 of 4)

TEST



panel schematic

5-35

NOTES

1. PARTIAL REF DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH UNIT NO. OR SUBASSEMBLY DESIGNATION
2. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, ±5% TOLERANCE, ½ WATT.
3. PHASE A FOR AZIMUTH
   PHASE B FOR ELEVATION

VE MOTOR ARM.

VE MOTOR ARM. RET.

— BRAKE RET.

— FIELD RET.

— TACH

— TACH RET.

— SHIELD

— BRAKE

— OVERLOAD

— OVERLOAD RET.

— FIELD

e 7-59. Servo amplifier schematic diagram

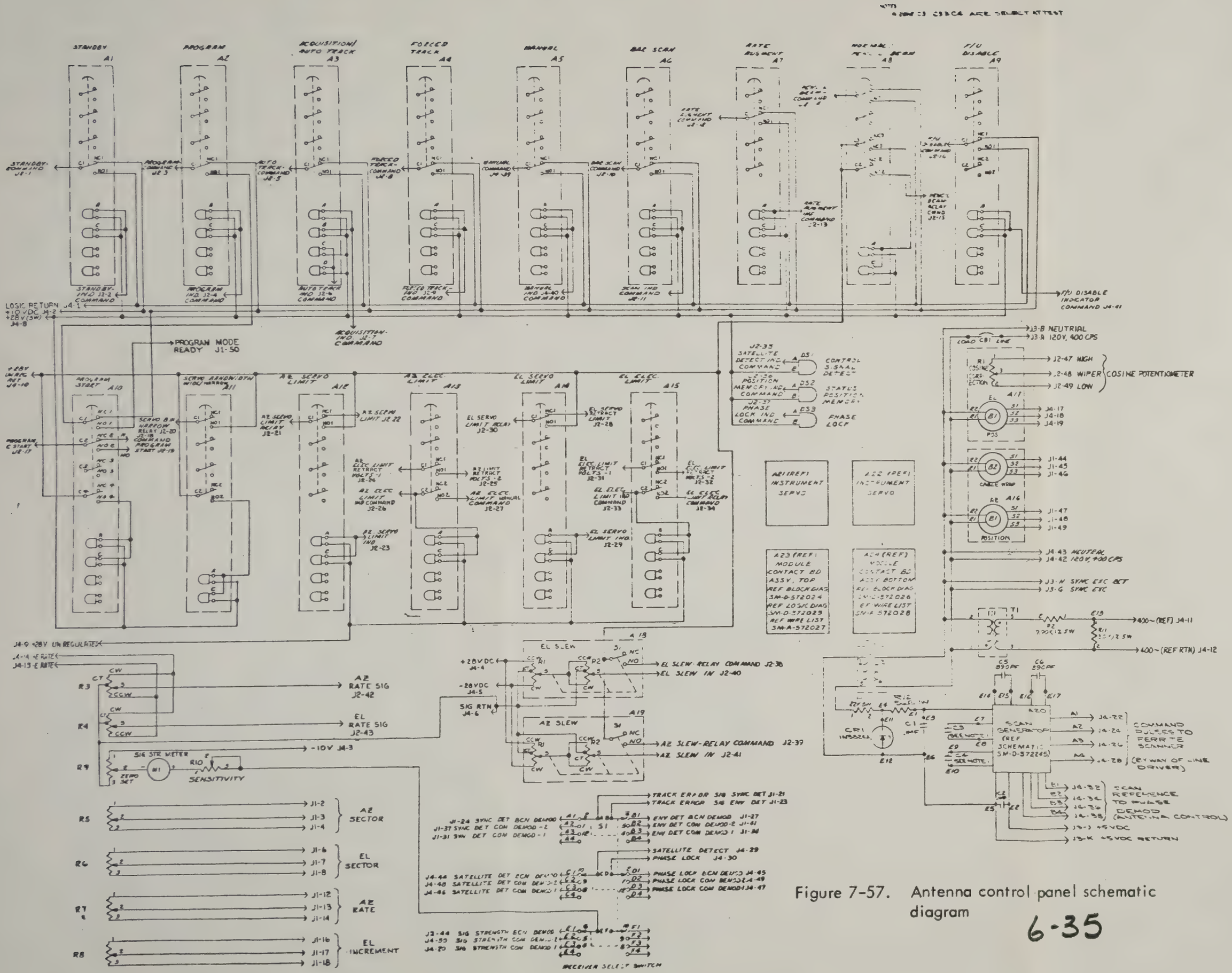


Figure 7-57. Antenna control panel schematic diagram

NOTES

1. PARTIAL REF DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH UNIT NO. OR SUBASSEMBLY DESIGNATION
2. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, ±5% TOLERANCE, ½ WATT.
3. PHASE A FOR AZIMUTH
   PHASE B FOR ELEVATION

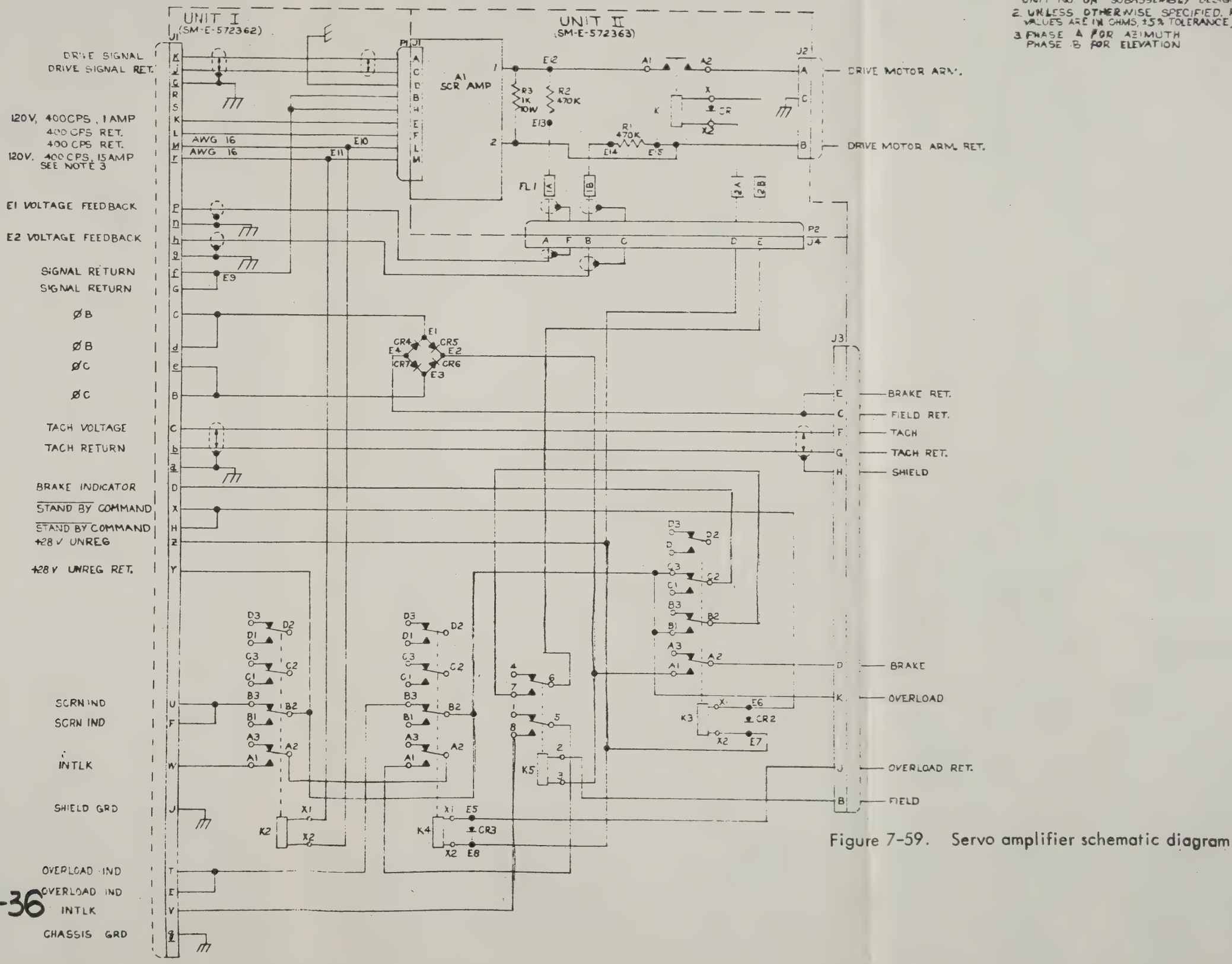
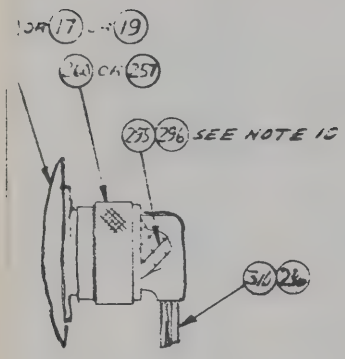
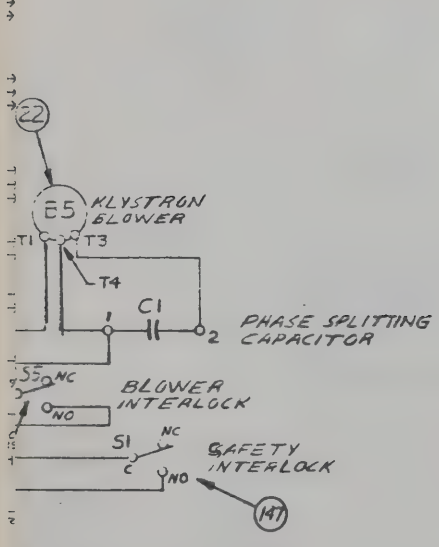


Figure 7-59. Servo amplifier schematic diagram





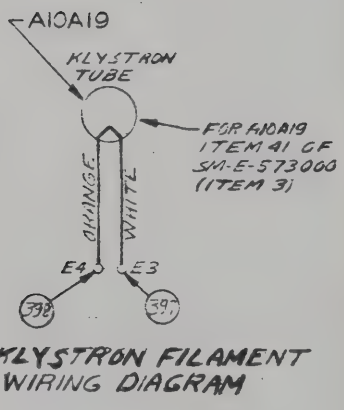


Figure 7-42. Pedestal base assembly diagram

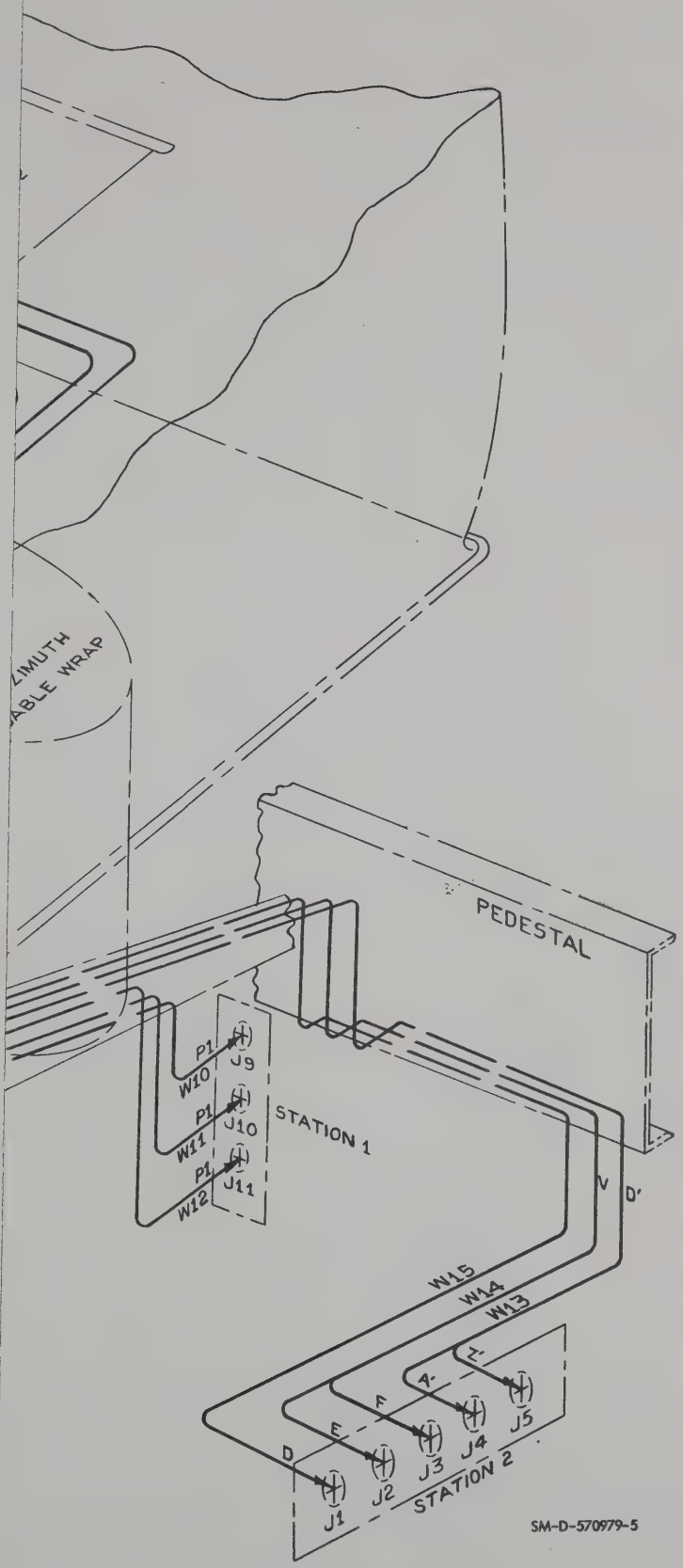
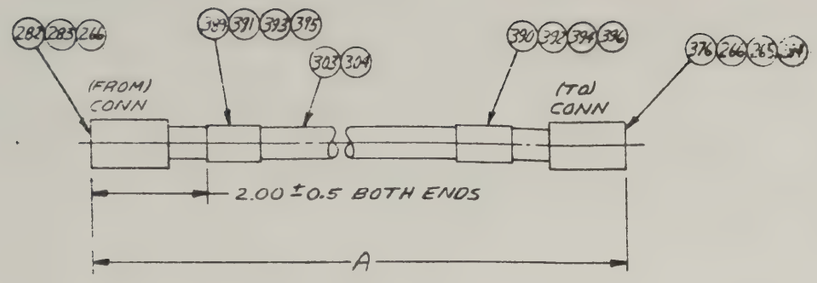
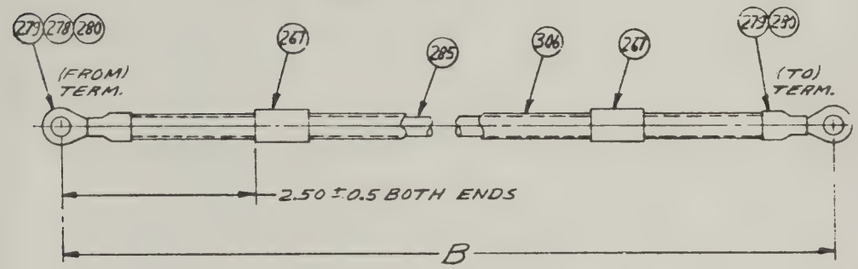


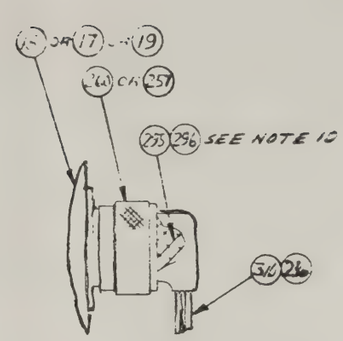
Figure 7-35. Pedestal base cable routing diagram



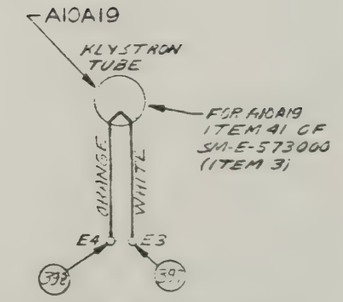
DETAIL X
SCALE-NONE



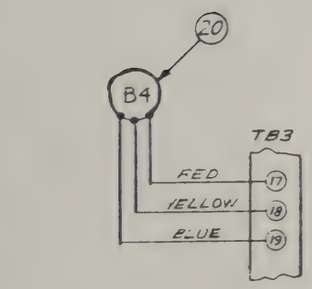
DETAIL Y
SCALE-NONE



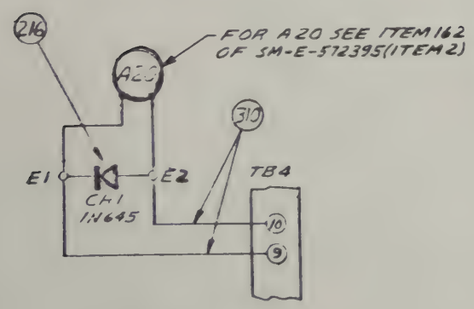
SECTION Z-Z SHS
(TYP 3 PLACES)
SCALE: NONE



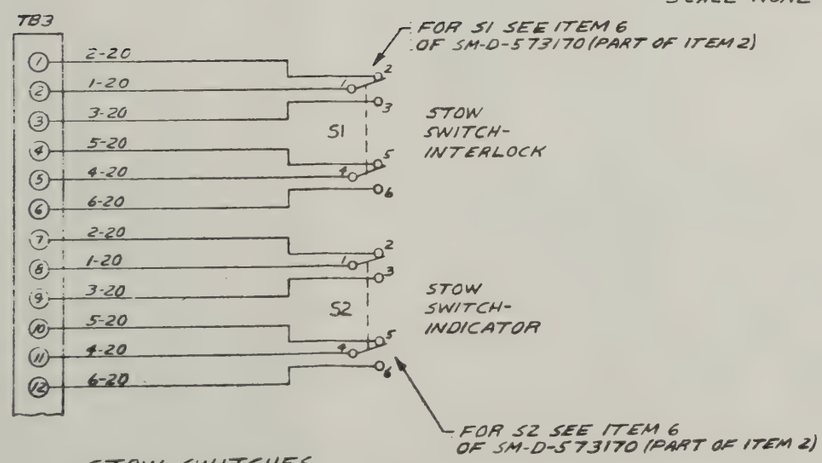
KLYSTRON FILAMENT
WIRING DIAGRAM



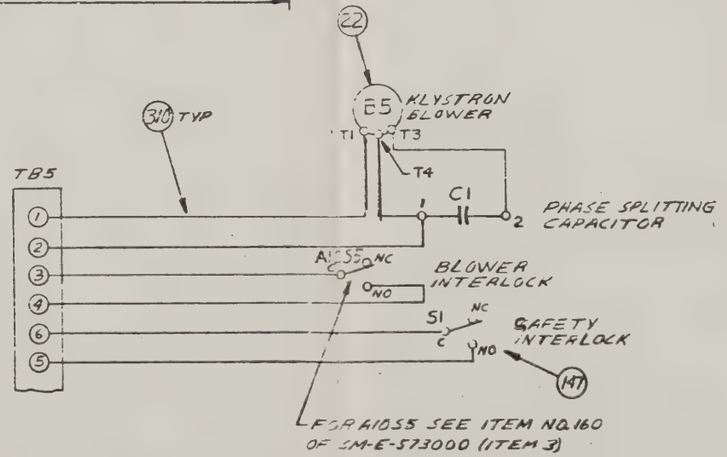
EXHAUST BLOWER
WIRING DIAGRAM



DC BRAKE
WIRING DIAGRAM


TB3
FOR S1 SEE ITEM 6 OF SM-D-573170 (PART OF ITEM 2)
STOW SWITCH-INTERLOCK
S1
STOW SWITCH-INDICATOR
S2
FOR S2 SEE ITEM 6 OF SM-D-573170 (PART OF ITEM 2)

STOW SWITCHES
WIRING DIAGRAM



KLYSTRON SAFETY COMPONENTS
WIRING DIAGRAM

Figure 7-42. Pedestal base assembly diagram

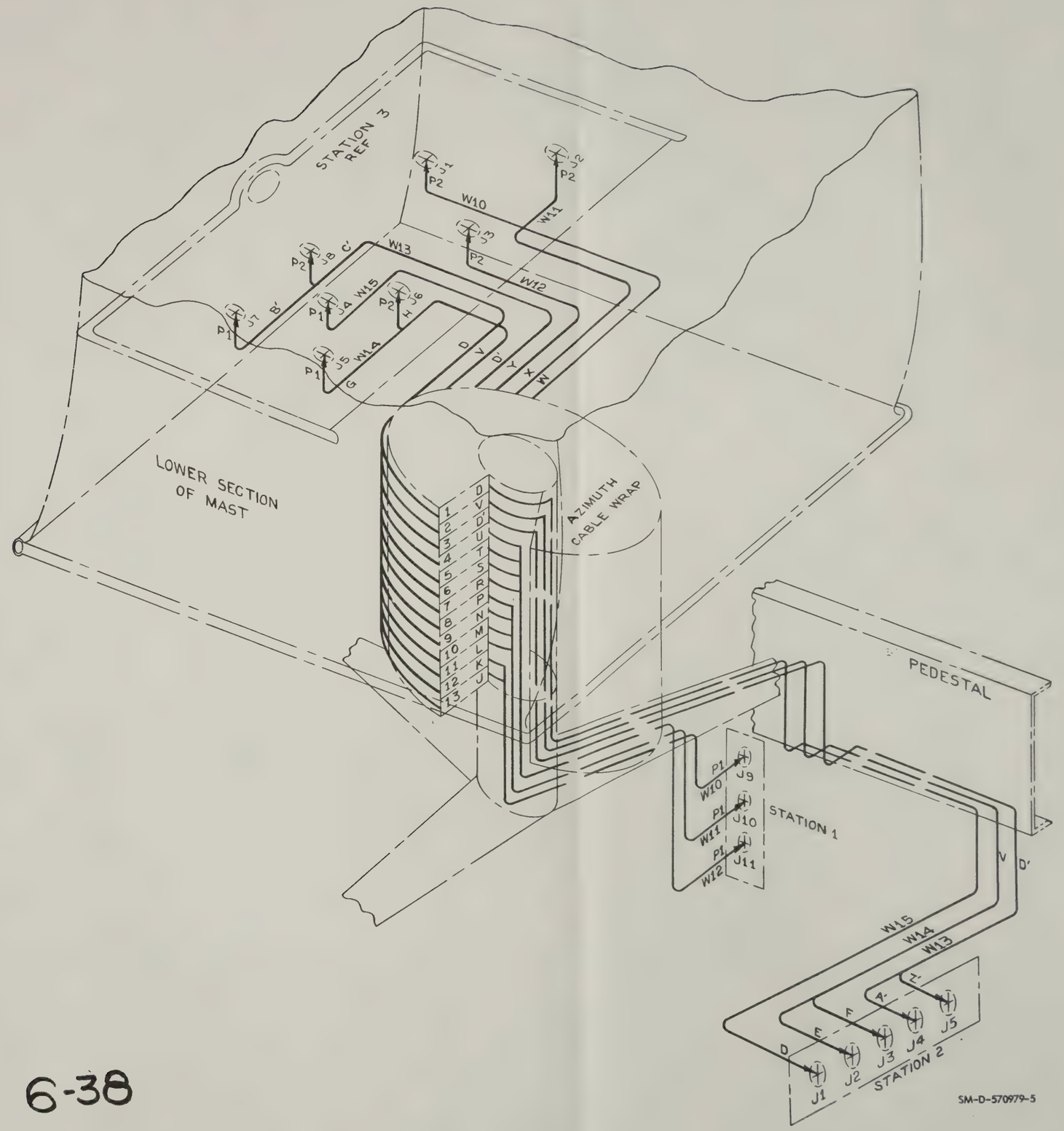


Figure 7-35. Pedestal base cable routing diagram

UNITED STATES ARMY
SIGNAL SCHOOL
FORT GORDON, GEORGIA

PRACTICAL EXERCISE

TRANSMITTER TURN ON AN/TSC-54

102-F6/A30-LP1-LP2-PE

APPROVED: 25 SEP 78

This document relates to TASK NO. 113-26Y-6031

This is a Signal School publication.

This Practical Exercise supersedes Practical Exercise 102-F6/A30-LP1-PE, dated 4 Jan 78

PRACTICAL EXERCISE

TRANSMITTER TURN ON AN/TSC-54

TASK:

Your objective will be to perform a complete turn-on of the HPA and LPA transmitters. You will also be required to clear all faults as they appear during preliminary checks. You will also be tasked to turn off the HPA and LPA as outlined in this exercise.

WHY YOU NEED THIS LESSON:

During power turn on of the transmitter section of the AN/TSC-54, a sequence of operations must occur. Turn on of the transmitter includes procedures for putting the High Power Amplifier (HPA) and Low Power Amplifier (LPA) in an "on-line" operational condition. The procedure used to turn on the AN/TSC-54 transmitter is covered in this exercise.

THINGS YOU WILL NEED TO KNOW AND USE:

1. Operate the AN/TSC-54 transmitter in a site terminal set up.
2. Perform preoperational checks.
3. Perform operational checks.
4. Turn on Low Power Amplifier (LPA).
5. Turn on High Power Amplifier (HPA).
6. Turn on of transmitter in general.
7. Safety practices.
8. Instructor assistance is available.

SAFETY PRECAUTIONS:

1. High voltages exist in this equipment and can cause injury or death on contact. High temperatures may exist in the antenna assembly RF box and transmitter equipment in the antenna pedestal. You must observe correct operating procedures as outlined in this guide, or as you are told to do by your instructor.

2. Ventilators should be open when vans are occuppied.

3. All ventilators on the antenna pedestal will be opened prior to turn on procedures.

4. Be sure that all equipment is properly grounded.

EQUIPMENT REQUIRED:

1. AN/TSC-54 transmitter section, HPA and LPA.

2. TM 11-5895-963-12.

3. TM 11-5895-389-12.

4. TM 11-5895-389-14.

5. Student tool kit.

PROCEDURES:

How you will perform tasks to reach your objective.

a. You will first learn the names and uses of transmitter components and units.

b. You will observe and perform preoperational checks.

c. You will observe and perform operational checks.

d. You will perform the turn on procedures required to bring up the LPA and HPA.

e. Finally, you will perform turn on and turn off procedures until you can meet required performance standards IAW specified organizational requirements.

LEARNING STEPS:

1. Introduction: The power amplifiers are used to raise low level RF signals to a higher level suitable for transmission through space. The use of HPA/LPA allows for the use of one amplifier to be "on-line" while the other is in standby. This also allows for maintenance as well as backup in case of emergency.

2. The procedure you will practice during transmitter turn on is designed to apply power to each amplifier system (HPA/LPA) its most efficient operation.

3. Table 3-3 in TM 11-5895-963-12 outlines the steps for power turn on of the Low Power Amplifier (LPA).

4. Paragraph 3-6 in TM 11-5895-389-12 outlines AN/TSC-54 and High Power Amplifier (HPA) operational procedures.

5. Turn on, AN/TSC-54 Transmitter, HPA.

   a. This part of the exercise should be completed within 20 minutes. If you go past 20 minutes ask for assistance from instructor.

   b. Reference TM 11-5895-389-12, para 3-6 for guidance.

   c. CAUTION:

      (1) Care must be taken to prevent damage to the klystron when turning on beam power. Make sure motor driven attenuator (AT-6) has maximum attenuation applied before turning on beam power.

      (2) Check coolant level in heat exchanger level, it should be at sight bar.

      (3) Do not use EMERGENCY OFF except after system critical power is OFF or during a real emergency.

      (4) Check the mount safe toggle switch to see that it is in the proper position for your operation.

NOTE: For testing of transmitter in dummy load only. For normal operation the mount safe switch will be in the down position.

      (5) Activate and release PRIME PWR on switch (momentary contact).

      (6) Antenna Pedestal, HPA.

         (a) Open access doors on transmitter control panel and primary distribution panel.

         (b) Open 6 pedestal air vent doors marked "OPEN DOOR(S) FOR OPERATION."

(c) Check to be sure that power distribution panel voltage meter indicates 120V and frequency meter indicates 400 Hz. Record reading.

119 Volts

398 Hz

(7) Set the following circuit breakers to the "ON" position; shelter pwr, heat exchanger, blowers, intercom/sensitive pwr, klystron filament, magnet pwr supply, beam pwr supply.

NOTE: The remaining circuit breakers will be covered in future lessons.

(8) Immediately check BEAM VOLTS and Klystron Body Current on antenna transmitter control panel. If Body Current is increasing, immediately turn off Magnet and Beam Power Supply circuit breakers.

d. Turn on procedures.

(1) Operation Control Van (OCV).

(a) Perform normal turn on procedure for OCV.

(b) Set control and pedestal - local key switch to pedestal position.

CHECK WITH INSTRUCTOR INSTRUCTOR'S INITIALS

(2) Antenna pedestal.

Check coolant level in heat exchanger. Coolant should be even with sight bar.

NOTE: Antenna should not be below 7.5° when transmitter is to be used in normal operation.

(3) Antenna transmitter control panel.

(a) Activate and release XMIT power on-off toggle switch to ON. Preheat light should illuminate. (Start of 9 minute delay.)

(b) Check klystron filament voltage. (Normal 6.5 to 7.5 volts.) Record voltage _____

(c) Check and record line voltage ØA_____ ØB_____ ØC_____.

CHECK WITH INSTRUCTOR INSTRUCTOR'S INITIALS

(d) Record magnet cur .6-.7, and TWT cathode cur Nominal. (Should read .6 to .7.)

(e) Record line volts Ph A_____, Ph B_____, Ph C_____.

(f) Zero RF power meter.

(g) Set RF power selector to DRIVE.

(h) Decrease XMIT output by holding toggle switch in down position until output power is Ø.

(i) Check desiccant chamber. Is the humidity at an acceptable level? 100

(j) Record air flow readings at intercom/air monitor panel; HUMIDITY .75 SCFH, RCVR 5 SCFH, TRANSMITTER DRIVER 2 SCFH, and TRANSMITTER HPA 5 SCFH. Will the flow indicators adjust even with their respective pointers? /

CHECK WITH INSTRUCTOR INSTRUCTOR'S INITIALS

(4) OCV.

(a) During 9 minute delay, set up converter to provide drive for transmitter.

(b) Patch MOD TEST at IF PATCH panel into desired up-converter.

(c) Set IF LEVEL attenuator switches for midscale indication on up-converter.

(d) Set RF output on desired up-converter to ON LINE.

CHECK WITH INSTRUCTOR INSTRUCTOR'S INITIALS

(5) Antenna pedestal.

(a) When standby indicator illuminates, place momentary contact beam power toggle switch in ON position.

(b) Transmit indicator should illuminate.

(c) Record the klystron body cur from left test meter 0 (approx .1) and the klystron beam volts from the right test meter _____ (approx .5).

(d) Zero RF power meter (must be zeroed each time used). Place RF power selector in FWD position.

CHECK WITH INSTRUCTOR ..... INSTRUCTOR'S INITIALS

(e) Place XMIT output switch in the increase position and hold until RF power meter indicates 1 kw.

(f) Record RF power in the rev position. What is the maximum scale deflection of meter in rev position? 1KW

(6) Return to OCV.

(a) Place PED/LOCAL key switch in local.

(b) Zero left hand circular RF output meter.

(c) Record RF output indications Forward 1KW, Drive _____, Reverse >100watt.

(d) Place alarm switch in inactive and depress 3 kw range button. Using zero set, zero RF power meter (square meter).

(e) Adjust fault limits to ±0.5 dB of output power and place alarm in activate position.

CHECK WITH INSTRUCTOR INSTRUCTOR'S INITIAL

6. Turn off Procedures, Transmitter.

a. OCV.

(1) Depress RF output button and lower output power to Ø watts. Place alarm in inactive position to silence alarm.

(2) Set beam on toggle switch to down position. Standby should illuminate.

CAUTION: A delay of approximately 5 minutes must be observed before proceeding to next step.

(3) Set XMIT on switch to down position.

(4) Turn critical on-off key switch to OFF and press emergency off afterward.

(5) Turn off OCV power switches and circuit breakers.

b. Antenna pedestal power distribution panel.

(1) Turn off beam pwr supply.

(2) Turn off magnet pwr supply.

(3) Turn off shelter pwr.

(4) Pull out or position to OFF all energized circuit breakers.

CHECK WITH INSTRUCTOR . . . . . INSTRUCTOR'S INITIAL

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7. Turn on, AN/TSC-54, Low Power Amplifier (LPA).

a. This part of the exercise should be completed within 20 minutes. If you go past 20 minutes ask for assistance from instructor.

b. Reference TM 11-5895-963-12, table 3-2 for sequence of steps for power turn on.

c. CAUTION:

(1) Care must be taken to prevent damage to the klystron when turning on beam power. Make sure motor driven Attenuator (AT-6) has maximum attenuation applied before turning on beam power.

(2) Check coolant level in heat exchanger. Level should be at sight bar.

(3) Do not use EMERGENCY OFF except after system critical power is off or during real emergency.

d. Turn on.

(1) At prime power control panel (antenna pedestal) set ac power to ON, verify that ac power indicator illuminates.

(2) Set low voltage PS, TWT, beam, filament and blower circuit breakers to ON.

(3) Verify that control-pedestal indicator on the LPA control panel is illuminated.

(4) Verify on control panel that preheat indicator is illuminated and TWT cathode current meter indicates at upper end of scale. Allow approximately one minute for TWT to come up.

(5) Lamp test: Momentarily set lamp test switch to the UP position and verify that all fault indicator lamps illuminate.

(6) On LPA control panel verify that no fault indicators are illuminated.

(a) If a fault indicator does appear, momentarily set fault-reset switch to up position and release.

(b) If fault indication persists, refer to section IV of chapter 4 for troubleshooting.

(c) Verify that equip, elev, and mount-interlock indicators are extinguished.

(7) RF power-meter zero/drive/reflected/output function switch to meter zero.

(a) Rotate power range switch to 15.

(b) Using meter zero potentiometer, adjust for zero indication on RF power meter.

(c) Rotate RF power-range switch to 1500.

(d) Rotate RF power-meter function switch to output position.

CHECK WITH INSTRUCTOR	INSTRUCTOR'S INITIALS

(8) After 6-minute warmup time.

(a) Verify that filament-preheat indicates extinguished and filament-ready indicator illuminates.

(b) Momentarily set transmit switch to LPA standby and release; verify that LPA standby indicator illuminates. Change 4/6 Sw

(c) Klystron-Body Current meter: adjust control, set trip adjustment point for a 50 milliampere indication.

1. Adjust klystron-voltage increase potentiometer to 0.0. (0.0 setting is performed at initial turn on and need not be adjusted again except for slight changes.)

2. Set beam-on switch to ON.

a. Verify that beam indicator illuminates and filament-ready indicator extinguishes. Ramp voltage Slowsdown Beam I for pu

b. Adjust klystron-voltage increase potentiometer, for 6.8 kv indication on beam voltage meter, lock the potentiometer. Factory ADJ.

c. Verify that beam current meter indicates approximately 680 milliampers.

(d) Set RF power-range switch to 1500.

(e) Momentarily set RF drive switch to ON. Verify that RF drive indicator illuminates.

(f) RF power-drive increase/decrease switch, momentarily hold in increase position until desired output is obtained.

(g) Rotate RF power-zero/drive/reflected/output function switch to reflected position. Verify that power level indication is no more than 1/10 of the transmitted power.

(h) Rotate RF power-zero/drive/reflected/output function switch to drive. Verify that power level indicator is 20 MILLIWATTS.

(i) Momentarily set RF drive switch to OFF; verify that RF drive indicator extinguishes.

(j) Set transmit switch to LPA ON LINE. Verify that LPA standby indicator extinguishes and LPA on line indicator illuminates.

(k) Set RF drive switch to on. Verify that the drive indicator illuminates.

8. Low Power Amplifier _____ Turn Off.

Shutdown procedures:

(1) On LPA control panel hold the drive - increase/ decrease switch down until meter indicates zero watts.

(2) Set RF drive switch to OFF.

(3) Set transmit switch to LPA standby.

(4) Set beam switch to OFF.

(5) On prime power control panel set BEAM, FILAMENT, and BLOWER circuit breaker switch to OFF (in order as listed).

(6) Set TWT circuit breaker to OFF.

(7) Set low voltage PS switch to OFF.

(8) On remote control panel, verify that all indicator lamps are extinguished except ac power.

(9) Set control switch to shelter.

(10) Set ac power switch to OFF.

CHECK WITH INSTRUCTOR INSTRUCTOR'S INITIALS

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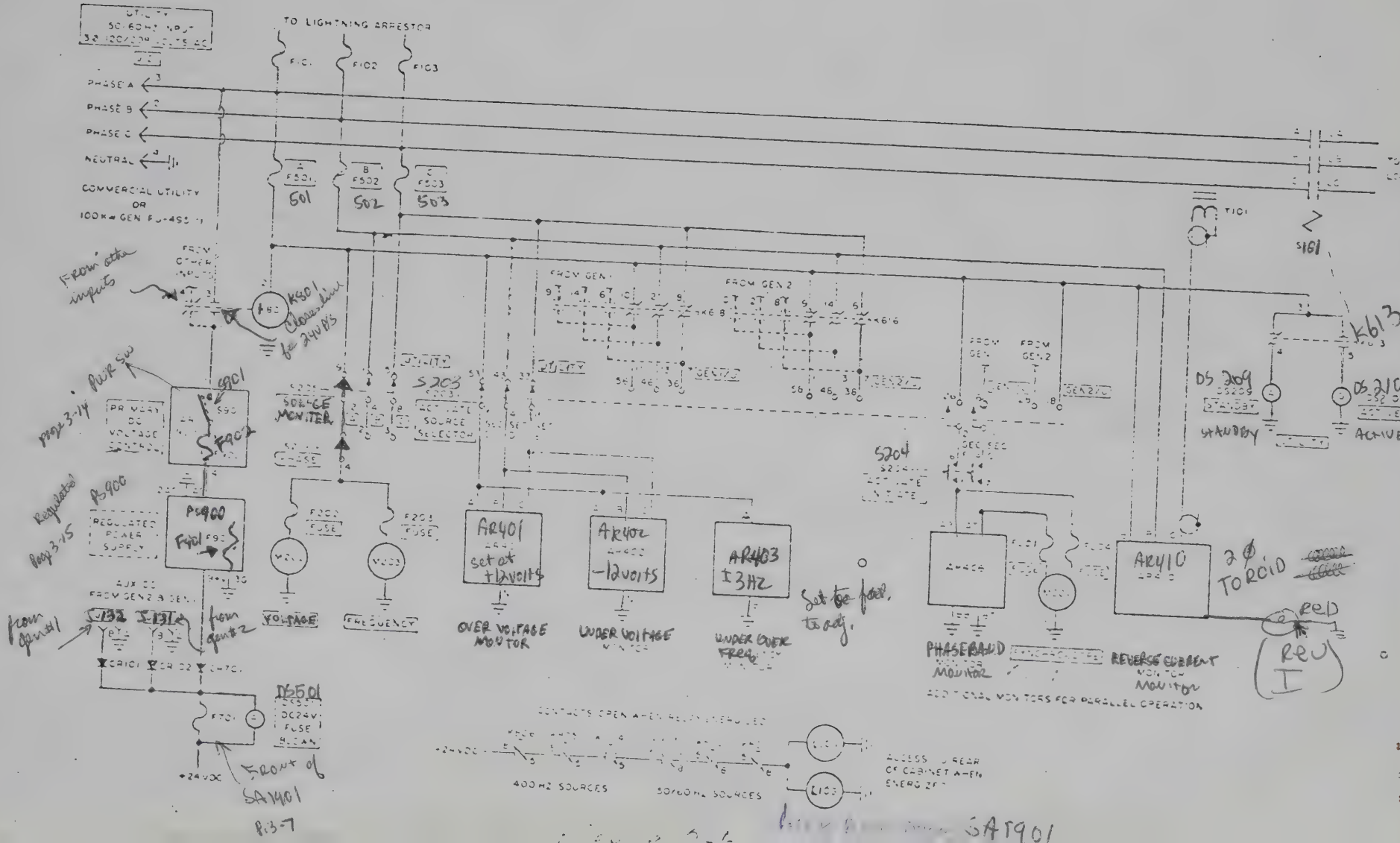
9. Troubleshooting: If time permits your instructor will provide you with additional faults to troubleshoot.

SUMMARY:

This exercise has given you the opportunity to develop your capability to adjust, align, and troubleshoot the AN/TSC-54 transmitting equipment and maintain it in a desired operational status. The lab experience has allowed you to apply the knowledge gained in the classroom as well as to test the quality of your troubleshooting skills.

END


TO LIGHTNING ARRESTOR
PHASE A
PHASE B
PHASE C
NEUTRAL
COMMERCIAL UTILITY
OR
100kw GEN
501
502
503
From other inputs
K501
Closes when 24VDC
From Gen 1
From Gen 2
T101
S101
K613
DS 209
STANDBY
DS 210
ACTIVE
S201
SOURCE MONITOR
S203
ACCEPTABLE SOURCE SELECTION
S204
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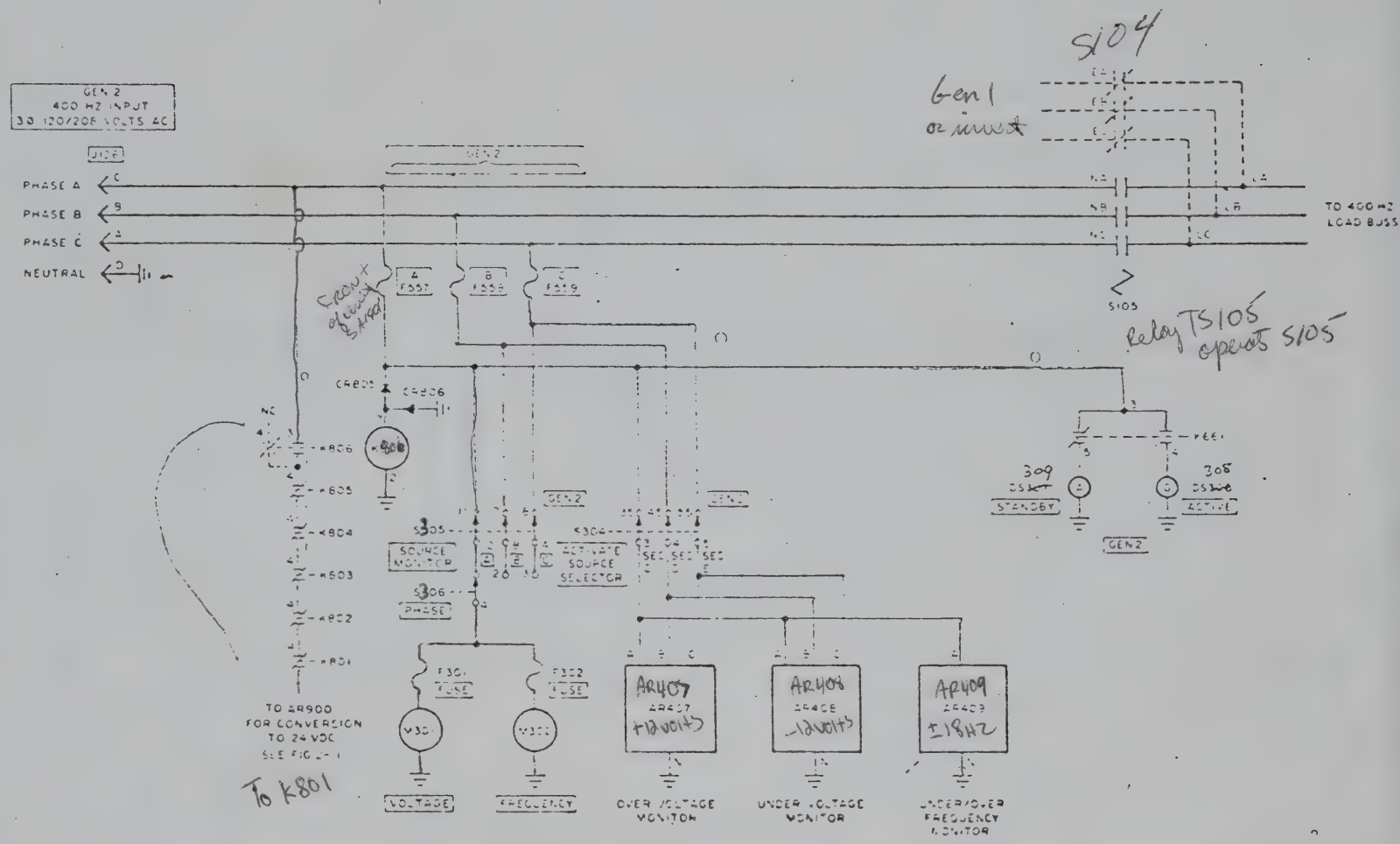
S104
Gen 1
or inverter
GEN 2
400 HZ INPUT
30 120/208 VOLTS AC
J106
400HZ
PHASE A
PHASE B
PHASE C
NEUTRAL
TO 400 HZ LOAD BUSS
S105
relay TS105 opens S105
CR805
CR806
K806
K805
K804
K803
K802
K801
TO AR900 FOR CONVERSION TO 24 VDC SEE FIG 2-1
To K801
S305
SOURCE MONITOR
S304
ACTUATE SOURCE SELECTOR
S306
PHASE
F301 FUSE
F302 FUSE
V301
V302
VOLTAGE
FREQUENCY
AR407
AR407
+12 VOLTS
OVER VOLTAGE MONITOR
AR408
AR408
-12VOLTS
UNDER VOLTAGE MONITOR
AR409
AR409
±18HZ
UNDER/OVER FREQUENCY MONITOR
309
STANDBY
308
ACTIVE
GEN 2

Figure 27

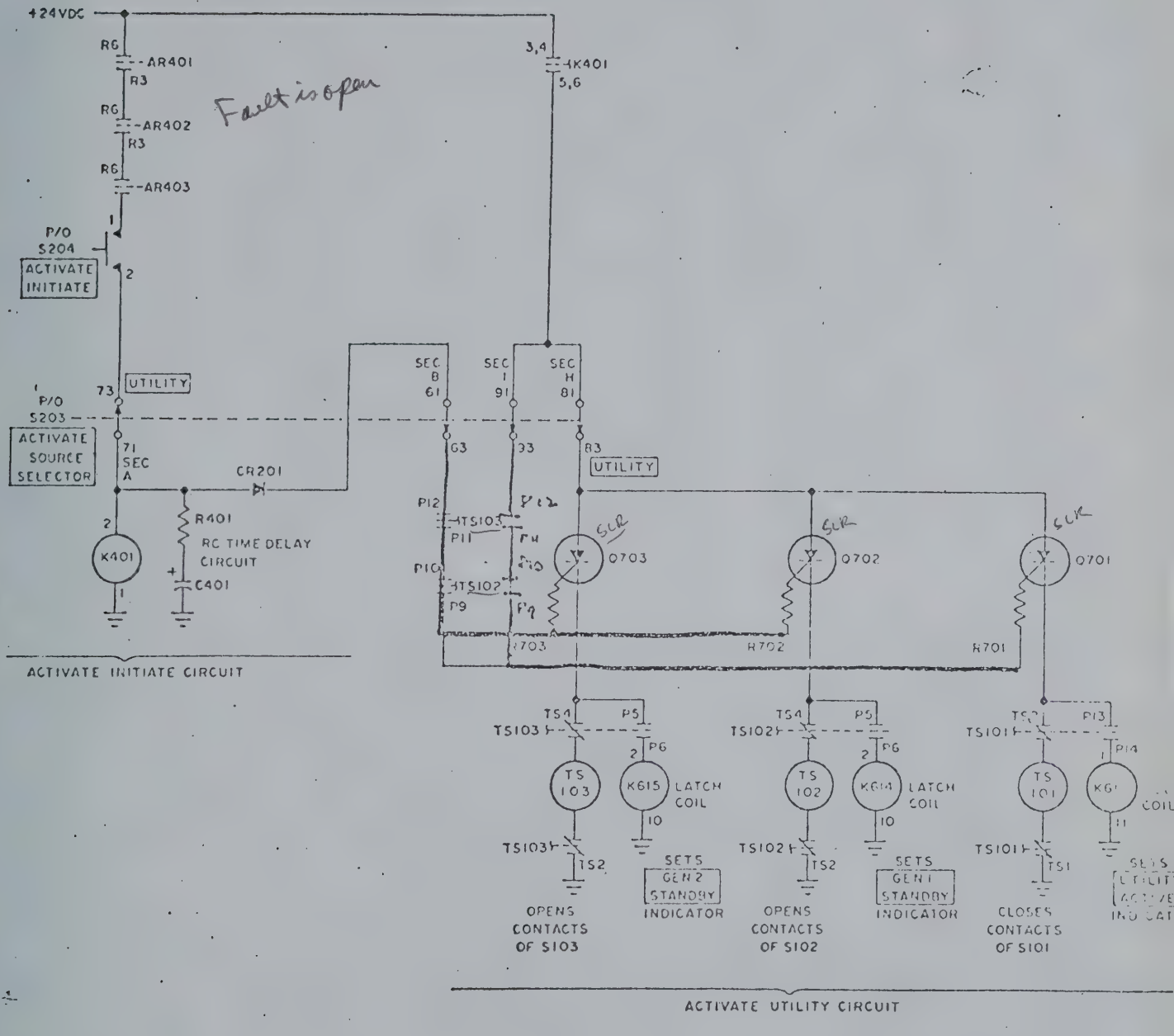

Figure 2-8. 50/60 Hz Single Source Control
Simplified Schematic Diagram

UNITED STATES ARMY
SIGNAL SCHOOL
FORT GORDON, GEORGIA

INFORMATION SHEET

PRIMARY POWER TURN-ON PROCEDURE

102-F6/A08-LP1-IS(3) APPROVED: 18 SEP 78

This is a Signal School publication.

TURN ON PROCEDURES

I. INTRODUCTION

An introduction to the AN/TSC-54 system was presented in the classroom, describing primary power distribution, shelter layouts and equipment location. This practical exercise will provide the opportunity to apply the knowledge gained in the classroom with actual experience in operation of shelter equipment.

II. SAFETY

a. WARNING - High voltages exist in this equipment and can cause injury or **DEATH** on contact. HIGH TEMPERATURES may exist in the antenna assembly RF Box and transmitter equipment in the antenna pedestal. All personnel must observe correct operating procedure.

b. Ventilators should be open when vans are occupied.

c. Be sure all equipment is properly grounded.

III. OPERATION

1. System primary power

   a. Turn on the following equipment and apply their outputs to the SA-1901

      NOTE: Be sure each is properly grounded

      (1) PU-495 generator

      (2) PU-401 generator

      (3) CV-3061 static frequency

   b. At the CV-3061, place one 60 Hz source and one 400 Hz source on-line as determined by instructor

2. TCC-79

   a. Application of primary power: perform the following:

      (1) Be sure TCC-79 is securely grounded

      (2) Power cable entrance panel 1A4: place all circuit breakers to OFF position

(4) Apply desired power source to TCC-79

(5) TCC-79 shelter, Power cable entrance panel 1A4: place the MAIN CIRCUIT BREAKER, CB-1 to the ON position.

(6) Power monitor panel 1A1: place the 50.60 Hz switch to the 60 Hz position. Place circuit breaker CB-1 to the ON position

(7) Monitor and record the frequency and voltage of the applied power

Phase A F._____ V._____

Phase B F._____ V._____

Phase C F._____ V._____

Are these readings within the tolerance required for operation?

_____

NOTE: Do not continue with power application if a fault condition is detected.

(8) 1A2: place circuit breaker CB-3 to ON position for lights in van.

(9) 1S1: place LIGHTS switch S1, and DOOR BLACKOUT OVERRI switch to ON position. Are the shelter lights on?_____

(10) Place the FIXTURE and BATTERY (emergency lighting) switches to ON

(11) Power cable entrance panel 1A4: place CB-2 to ON, and turn on shelter air conditioner pwr to air cond.

b. Anser the following questions

(1) What primary power is required for the TCC-79?

60Hz

_____

(2) If the input frequency or voltage deviates out of tolerance, what type of indications are available to the operator?

?

_____

(3) What switches must be on in the TCC-79 in order for the lights to be on?

CB3-1A2 S1 S2, Blank out covers

(4) What precautions should be taken before connecting primary power?

Make Sure ⏚

* TURN ON Rest of CKT BREAKERS ON 1A2.

c. Turn on shelter equipment: perform the following:

(1) Alarms: enable

(a) 1A1 - place ALARM OVERRIDE switch to OFF ~~7A3~~,

(b) 7A4 - ALARM CUTOFF switches NOT CUTOFF (horizontal)

(c) 11A6 - MANUAL OVERRIDE switch OFF

(d) 12A1 - MINOR ALARM to NORMAL
MAJOR ALARM to CUTOFF (disabled)

NOTE: Major alarm placed in cutoff to disable audible alarm which would otherwise sound during turn-on procedure. For normal operations it would be in NORMAL position.

(e) 12A8 - ALARM switches to NORMAL

(f) 12A10 - Group 1 through 5 ALARM switches to NORMAL

(g) 12A13 and 14 - ALARM switches to NORMAL

(h) 13A7, A8, A10, and A11 - ALARM switches to NORMAL

(i) 13A12, A13 ALARM switches

1 Remove plastic covers

2 ALARM switches (white buttons below lights) OUT (enabled)

(2) 1A2 - All circuit breakers to ON

(3) 8A10 - Turn on ± 6V power supplies

(4) 10A3 - Select power supply No. 1 ON

(5) 10A2, A4 - Turn on 48 VDC power supplies. Record power supply voltages and currents

PS-1 Voltage 48 Current 6.4 mA

PS-2 Voltage _____ Current _____

(6) 5A1 - Turn on monitor amplifiers

(7) 6A1 - Tripack oscillator and voltmeter ON

(8) 8A1, A3 - All keyers to LINE

NOTE: The frequency shift keyers are now ready to process user DC TTY inputs

(9) 8A13 - POWER switch ON

(10) 8A5 - Electrical service LOCAL COPY to ON

NOTE: The teletype printer will now print what is typed on local keyboard

(11) 9A1 - Pattern generator ON

(12) 9A2 - Distortion analyzer ON

(13) 9A5 - All keyers (4) to LINE

(14) 9A7, A9, A11, A13, A15 - All Liu's to ON

(15) 11A5 - Turn POWER to ON and record the following as satisfactory.

+28 VDC _____
-6 VDC _____
+6 VDC _____

(16) 11A6 - Turn Power to ON and record the following as satisfactory or unsatisfactory

+28 VDC _____
-6 VDC _____

NOTE: If audible alarm sounds, place MANUAL OVERRIDE to ON to silence it

(17) 12A1 - Set AC CIRCUIT BREAKER to ON

(18) 13A2 - Frequency Selective Levelmeter POWER switch to AC

(19) 13A7 - Set both AC CIRCUIT BREAKERS to ON

d. Answer the following questions

(1) Where is selection of the ON LINE/REDUNDANT 48 VDC power supply made? 10A3

(2) What function does the LOCAL COPY switch perform?

Give You Copy

(3) What is the total number of Keyers in the TCC-79 20.

e. Shutdown of shelter equipment: perform the following:

(1) Turn off the following equipment

(a) Master Frequency generators, 13A7

(b) Frequency Selective Levelmeter, 13A2

(c) Indicator power supply, 12A1

(d) FM Modulator and Demodulator, 11A5 and 11A6

(e) Line Isolation Units 9A7, A9, A11, A13, A15

(f) Tactical frequency shift keyers, 9A5

(g) Pattern generator and distortion analyzer, 9A1, A2

(h) Teletypewriter, 8A13

(i) User Frequency Shift Keyers, 8A1, A3

(j) TRIPACK, oscillator and voltmeter, 6A1

(k) Monitor amplifiers, 5A1

(l) 48VDC power supplies, 10A2, A4

(m) 6VDC power supplies, 8A10

(2) Load Center 1A2: turn-off all circuit breakers except CB-3

(3) Turn off air conditioner, then CB-2 at 1A4

(4) Place circuit breaker CB-3 (at 1A2) to off

(5) Power Monitor Panel 1A1: CB-1 to off

(6) Place MAIN CIRCUIT BREAKER CB-1 on 1A4 to OFF

(7) Turn off the EMERGENCY LIGHTING system

(8) Turn-off input power to TCC-79 at the SA-1901

f. Answer the following questions

(1) Why should you turn the emergency lighting switch off after shutting the system down?

So you don't drain batt

(2) Why is it good practice to turn off individual equipment before turning off the main power circuit breakers?

Surge

3. AN/TSC-54 Satellite Communications Terminal

a. Application of primary power and turn-on

(1) Check to see that the antenna pedestal and OCV are properly grounded. Be sure the six air vent doors on the antenna pedestal marked OPEN for OPERATION are open, OCV air vents are open (front of van)

(2) Apply primary power from the SA-1901 to the antenna pedestal

(3) On antenna pedestal primary power distribution panel, 2A3A14:

(a) Check input voltage and frequency and record below

Voltage _____ Frequency _____

(b) Log running time indicated on SENSITIVE PWR and SYSTEM PWR meters below.

Sensitive Power _____
System Power _____

(c) MOUNT SAFE switch ON (up)

NOTE: Mount Safe must be OFF to move the antenna or to transmit

(d) OVERRIDE switch OFF (down)

(e) PRIME POWER ON toggle switch to ON position: listen for main power contactor to "click"

NOTE: Prime power on switch is spring loaded and will return to down position after engaging main power contactor

(f) Press all push-button circuit breakers ON (in)

(g) SHELTER PWR circuit breaker to ON (up)

NOTE: Do not turn on Magnet pwr supply or beam pwr supply ckt breakers - these are associated with the transmitter and certain safety checks must be made which will be given in a later class.

(4) At antenna RF box, 2A9A1A2, turn PARAMP POWER switch ON

NOTE: This switch is normally left on even when system is off

(5) On primary power monitor panel 1A16, check frequency and voltage of incoming power, and record below

Frequency _____

Voltage: Phase A _____
Phase B _____
Phase C _____

On power distribution panel 1A2A4, turn CRITICAL POWER key switch to ON

(6) At OCV power distribution assembly 1A12 and power distribution box 1A15, press all circuit breakers to ON (in). Do not turn heater switch on.

(7) Turn on communications console (1A2, A3) equipment one rack at a time, from top to bottom, from left to right as follows:

(a) Frequency distribution unit 1A2A22 to ON

1 If cesium beam standard is in the system press CESIUM STD

2 If not, press XTAL STD

(b) 1A2A4 - Critical Power Key Switch to ON; all power supply switches (7) to ON.

NOTE: BE CAREFUL NOT TO BUMP EMERGENCY OFF SWITCH

NOTE: To silence AUDIBLE ALARM, press ALARM DISABLE switch on RF power monitor and control panel, 1A2A27

(c) 1A2A5 - 400 CPS REF switch to ON

(d) 1A2A7 - MOD PWR to ON; meter POWER switch to ON

(e) 1A2A30, A31 - POWER switches to ON

(f) 2 Kw Static Frequency Converter - all switches (3) to ON

(g) 1A3A23 - UGC-77 Teletypewriter to ON

(h) 1A3A9, A10 - all switches to ON

(i) 1A3A16 - 1275, 3805, 3995 frequency shift keyer to LINE

(j) 1A3A26 - 6V POWER switch to ON: then all LIU's (3) to ON

(k) 1A3A19 - EXTERNAL blowers ON (internal blowers OFF)

(8) Turn on Up/Down converter racks one at a time, from right to left, from bottom to top, as follows:

(a) 1A18A9 - POWER to ON

(b) 1A18A6 - POWER to ON

(c) UP converter No. 3 - POWER to ON

(d) 1A19A8, A6 - POWER to ON

(e) 1A19A5 - POWER to ON

(f) Down converters 1 and 3 - POWER to ON

This completes turn on procedures, except for the transmitter which will be given in a later class

b. Answer the following questions:

(1) Where can you monitor input power voltage and frequency?

_____

(2) Why must the antenna pedestal be turned on before the OCV?

Pwr goes then Ant Before OCV

_____

(3) **When the EMERGENCY OFF SWITCH is activated what affect will it have on relay K-4 (prime power)?**

_____

c. Shutdown of equipment

(1) Turn off down converter equipment (1A18, 19) from top to bottom, left to right.

(a) Down converters

(b) Test translator, 1A19A5

(c) Down converter Synthesizer, 1A19A6, A8

(d) Up converters

(e) Distribution amp, 1A19A6

(f) Up converter synthesizer, 1A19A9

(2) Turn off communications console equipment from bottom to top, right to left.

(a) External blowers - 1A3A19

(b) LIU's, then power supply - 1A3A26

(c) Frequency shift keyers - 1A3A16

(d) Baseband and demodulator power supplies - 1A3A10, A9

(c) UGC-77 TTY - 1A3A23

(f) 2kw static frequency converter, 3 switches

(g) Equalizers - 1A2A31, 30

(h) Power meter, and modulator - 1A2A27

(i) 400 Hz reference for antenna control - 1A2A5

(j) 1A2A4. Power Supplies (7), and critical power key switch

NOTE: DO NOT HIT EMERGENCY OFF

(k) Frequency distribution unit - 1A2A22

(l) Pull all circuit breakers on 1A12 and 1A15

(3) Turn off antenna pedestal -

(a) Turn off SHELTER PWR - 2 A3A14

(b) Pull all other circuit breakers - 2A3A14

(c) Lift red cover on the side of the power entrance panel and actuate EMERGENCY OFF switch. This disengages main power contactor.

(4) Turn off input power to the antenna pedestal at the SA-1901

d. Answer the following questions

(1) What is the purpose of the EMERGENCY OFF switch?

_____

_____

How many are there? _____

Where are they located? _____

_____

4. SUMMARY: This practical exercise has been designed to provide you with the experience necessary to apply power to the AN/TSC-54 system. You should now be able to perform this operation safely and without assistance.

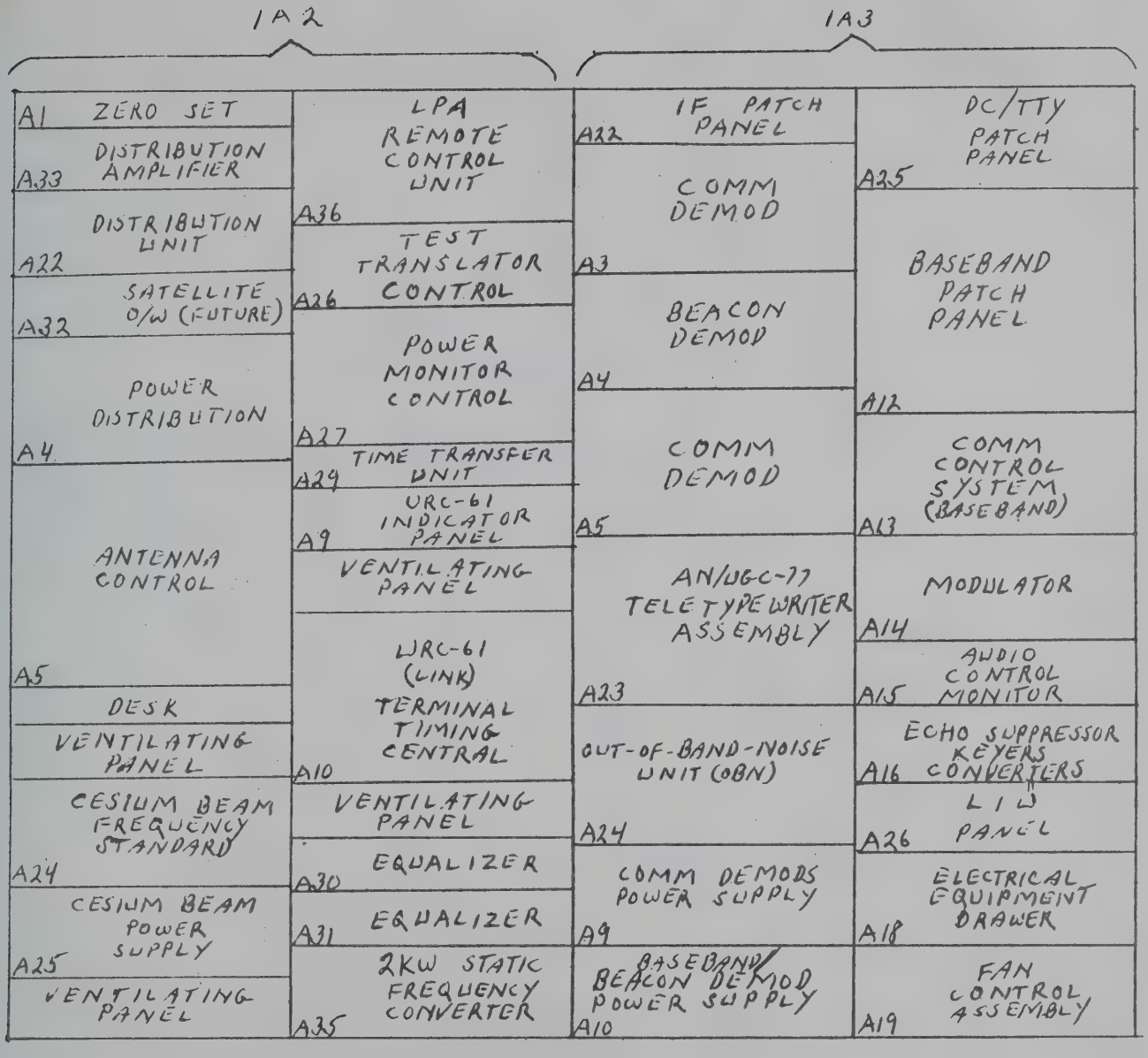

Figure 1-1. Electronic Equipment Shelter S-378/TSC-54, component location.

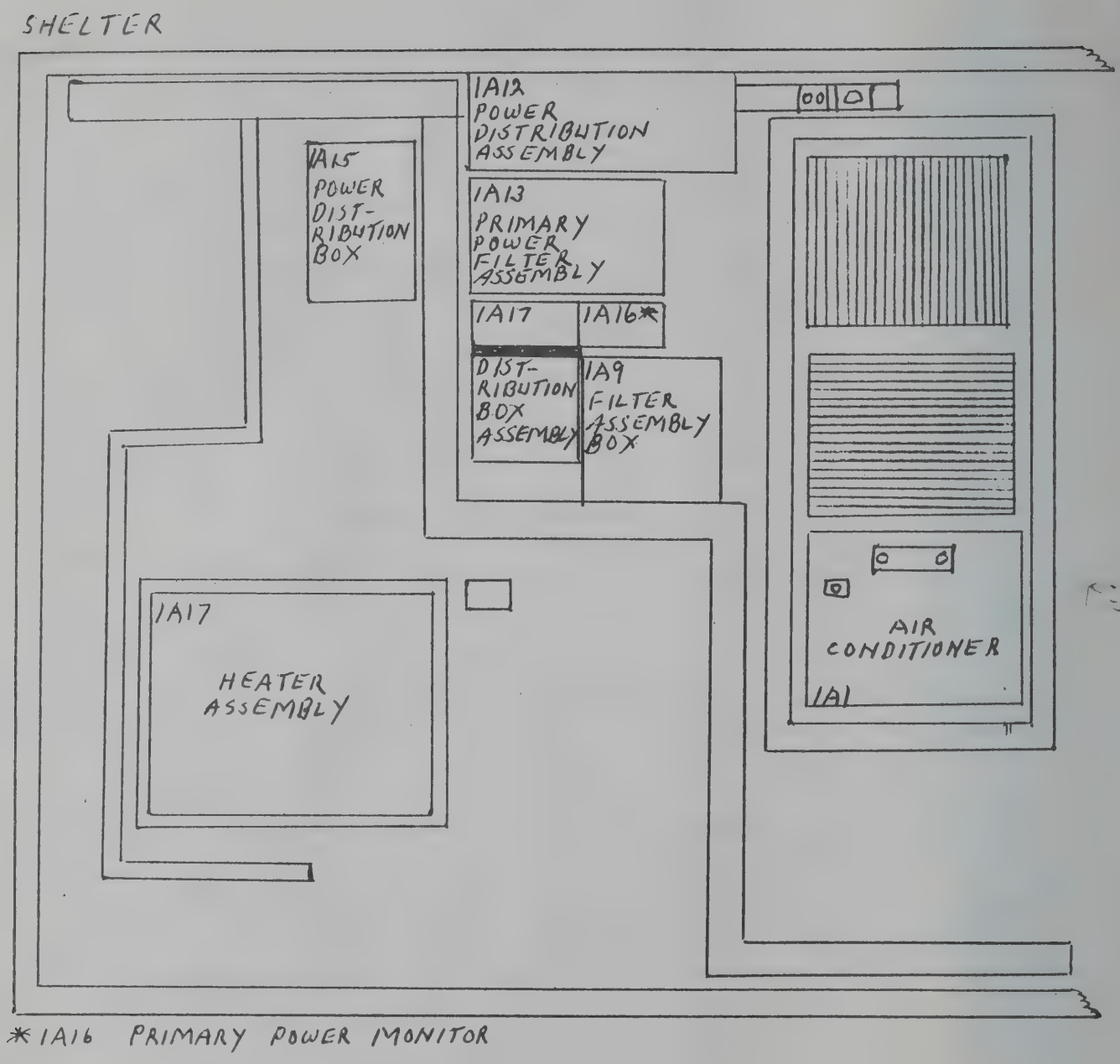
SHELTER
1A12
POWER
DISTRIBUTION
ASSEMBLY
1A15
POWER
DIST-
RIBUTION
BOX
1A13
PRIMARY
POWER
FILTER
ASSEMBLY
1A17
1A16*
DIST-
RIBUTION
BOX
ASSEMBLY
1A9
FILTER
ASSEMBLY
BOX
1A17
HEATER
ASSEMBLY
AIR
CONDITIONER
1A1
*1A16 PRIMARY POWER MONITOR

Figure 1-2.

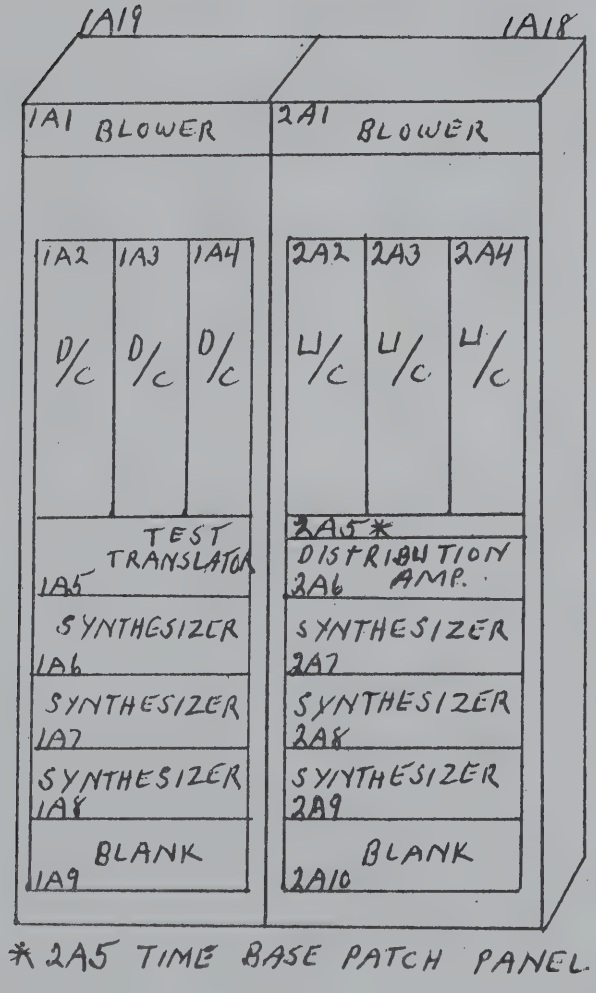

Figure 1-3.
UP/DOWN
CONVERTER RACK

Jamison Lane
UNITED STATES ARMY
SIGNAL SCHOOL
FORT GORDON, GEORGIA

PRACTICAL EXERCISE

POWER SYSTEMS

102-F6/A06-LP1-PE

TRIAL DRAFT 6 Jan 78

This is a Signal School publication.

PRACTICAL EXERCISE

POWER SYSTEMS

1. Introduction:

The Power Distribution and Switching Unit SA-1901/TSC-54, controls, indicators and current flow was presented during classroom instruction. This practical exercise is designed to apply the knowledge you gained during those periods and providing experience in operating and performing test procedures on the equipment.

2. Safety.

a. Personnel Safety.

(1) High voltage is present through out this equipment. Death on contact may result if the proper safety procedures are not observed.

(2) Do not attempt to operate this equipment without proper ground connections.

b. Equipment Safety.

3. Operation.

a. Preliminary Starting Procedure.

WARNING - If any one of the preoperational procedures or test is inconclusive or a malfunction in the equipment is present, do not energize any portion of the equipment until 100 percent normal operation is insured.

(1) Check the mechanical override of the interlock system as follows:

(a) Remove the plugs covering each access hole near the rear door handle.

(b) Insert a thin rod or screwdriver through the exposed hole with one hand and push the interlock plunger (one on each door) away from the door latch while turning the handle with the other hand.

(c) Close the doors by pushing the plunger away from the latch while turning the handle. Leave door closed.

(d) Replace the access hole plugs removed in (a) above.

WARNING - Never attempt to mechanically release the door interlock during normal operation.

(2) Make sure that DC power cable is attached to the PU-495/U power generator and to the dc connector panel of the SA-1901.

(3) Silence the horn now by depressing both alarm silence horn push-button switches.

(4) Rotate the voltage adjust screwdriver adjustment on the 24VDC power supply control fully counterclockwise.

(5) Check normal operation of the interlocks by opening and closing the back doors.

NOTE: The interlock mechanisms will be released by the applied dc power.

(6) Leave the doors open and station a man at the open doors for safety.

(7) Attach the Commercial utility power and power generator set AC cables to the input connector panel.

(8) Set all SA-1901/TSC-54 circuit breakers to OFF.

(9) Check to be sure that utility parallel switch S401 is in the down position. OFF

(10) Apply utility power.

(11) Observe that the neon lights on the lightning arrestor, located in the base of the SA-1901/TSC-54 are glowing.

NOTE: The lightning arrestor is connected only to the commercial power input line.

(12) Apply power from the PU-495/U power generator and set the ac circuit breakers on the 50/60 Hz control panel to ON. don't have

(13) Observe for normal indication of voltage (120vac $\pm$ 12 volts) and frequency (60Hz $\pm$ 3) on the 50/60 Hz control panel voltage and frequency meters.

(14) Using a TS-382/U, measure the AC voltage between phase A,B,C, and neutral (N) in the output connectors. The voltage should be zero.

(15) Set all AC circuit breakers to OFF and remove all generator power.

(16) Close rear doors.

(17) Connect 50/60 Hz AC output power cables to the output connector panel.

(18) Apply AC power and set the circuit breakers to ON.

(19) Depress the activate initiate pushbutton switch and observe that the green active indicator lamp is illuminated.

b. Normal Operating Procedures.

NOTE: To connect or disconnect power cables safety, turn the associated power generator control panel circuit breaker to OFF.

(1) Determine the source of 50/60Hz voltage to be utilized (utility power source, PU-495/U power generator No. 1, or PU-495/U power generator No. 2) and set the activate source selector rotary selector switch to the proper position.

(2) Observe that the amber standby indicator lamp for the selected power source is illuminated.

(3) Set the source monitor rotary selector switch to the position corresponding to (1) above.

(4) Rotate the phase selector switch to each position in turn, and observe that the voltage and frequency meters indicate that the source is within the normal operating range.

(5) Depress the Activate Initiate pushbutton switch.

(6) Observe that the green Active indicator lamp is illuminated.

c. 400 Hz Single Source Operating Mode.

(1) Determine the 400Hz voltage source to be utilized (Frequency Converter, PU-401/M power generator No.1, or PU-401/M power generator No. 2) and set the activate source selector rotary switch to the proper position.

(2) Set the Source Monitor rotary switch to the source selected in (1) above.

(3) Rotate the phase selector switch to each position and in turn, observe that the voltage and frequency meters indicate within the normal operating range.

(4) Observe that the standby amber indicator lamp for the source selected is illuminated.

(5) Depress the Activate Initiate pushbutton switch.

(6) Observe that the Active green indicator lamp for the source selected is illuminated.

4. Test Procedures and Performance Standards.

a. Alarm Circuit and Malfunction Indicator Operational Test.

(1) Step 1, Equipment under test: 50/60Hz Activate Source Selector S203 or (S304, 400Hz).

(a) Set 50/60 Hz activate source selector to a standby source not supplying power to SA-1901/TSC-54 and start timeing in seconds.

RECORD START TIME_____

(b) Standby and Active indicators not lighted. Horn alarm sounds, overvoltage, undervoltage, under/overfrequency indicators light. Record stop time in seconds.

RECORD STOP TIME_____

(c) Elapsed time should be between 3 and 10 seconds.

RECORD ACTUAL TIME_____

(2) Step 2, Change position of Activate Source Selector to the Active source.

(a) Horn alarm silences. Overvoltage, undervoltage, under/over frequency indicators remain lighted.

RECORD START TIME_____

(b) Horn alarm sounds. Overvoltage, undervoltage, under/over frequency indicators still lighted.

RECORD STOP TIME_____

(3) Step 3, Alarm Silence Horn S202 (60Hz) and S302(400Hz)

(a) Press Alarm Silence Horn Switch.
(b) Horn alarm silences. Overvoltage, undervoltage, under/over frequency indicators still lighted.
(c) Repeat Steps 1 and 2 above.

b. Overvoltage, Undervoltage, and Under/Over Frequency Monitor Parameter.

(1) Step 1, 50/60 Hz Control panel.

(a) Request standby power from generator 1 or generator 2.
(b) Standby indicator lights.

(c) 50/60 Hz Source Monitor Switch S205 (S305 400Hz). Set to monitor source indicated by standby indicator.
(d) Voltage should read 120 VAC ± 12. Frequency should read 60Hz ± 3.

VOLTAGE READING_____
FREQUENCY READING_____

(e) 50/60 Hz Phase switch S206, 60Hz and (S306, 400Hz). Sweep through all settinga A,B,C, returning to A.

VOLTAGE	FREQUENCY
A_____	A_____
B_____	B_____
C_____	C_____

(2) Step 2.

(a) Request gradual decrease of standby output voltage to 100VAC.

(b) Start timing when voltage reading is 108VAC.

START TIME_____

(c) Stop timing when horn alarm sounds.

STOP TIME_____

(d) Elapsed time should be between 3 and 10 seconds. Under voltage indicator is lighted. Horn alarm sounding.

(e) Inactive standby indicator may light as a result of start up signal sent to inactive generator station.

(3) Step 3, Activate initiate switch S204 (S303, 400Hz).

(a) Press switch and release.
(b) Generator input remains in standby. No switching occurs.
(c) Request gradual return to 120VAC.
(d) When voltage reading is 108VAC.
(e) Alarm horn stops sounding undervoltage indicator remains lighted.

(4) Step 4, Alarm Reset Malfunction Indicator Switch S201 (S301, 400Hz)

(a) Press switch.
(b) Undervoltage indicator extinguishes.
(c) Request gradual increase of standby output voltage to 140VAC.
(d) Start timing when voltage reading is 132VAC.

RECORD TIME START_____

(e) Stop timing when horn alarm sounds.

RECORD TIME STOP_____

(f) Elapsed time should be between 3 and 10 seconds. Horn alarm sounding and overvoltage indicator lighted.

(5) Step 5, Activate Initiate Switch S204 (S303, 400Hz)

(a) Press Switch.
(b) Generator input remains on standby. No switching occurs.
(c) Request gradual return to 120VAC, when voltage reaches 128VAC.
(d) Horn alarm stops sounding. Overvoltage indicator remains on.

(6) Step 6, Alarm Reset Malfunction Indicator Switch S201 (S301, 400Hz)

(a) Press Switch.
(b) Overvoltage indicator goes out.

(c) Request gradual increase in standby output frequency to 54Hz. (400Hz at 380Hz)
(d) Start timing when frequency reading is 57Hz. (400Hz at 380Hz)
(e) Stop timing when Horn alarm sounds.

RECORD START TIME_____
RECORD START FREQUENCY_____

(e) Elapse time should be between 3 and 10 seconds. Horn alarm sounding. Under/over frequency indicator lighted.

(7) Step 7, Activate Initiate Switch S204 (S303, 400Hz)

(a) Press Switch.
(b) Standby indicator remains lighted. No switching occurs.
(c) Request gradual return to 60Hz. (400Hz to 400Hz)
(d) When frequency reading reaches 58Hz. (400Hz, 381.5Hz)
(e) Alarm Horn stops sounding. Under/over frequency indicator remains lighted.

(8) Step 8, Alarm Reset Malfunction Indicator Switch S201 (S301, 400Hz)

(a) Press Switch.
(b) Under/over frequency indicator extinguishes.
(c) Request gradual increase in standby by output frequency to 66Hz. (400Hz to 430Hz)
(d) Start timing when frequency reading is 63Hz. (400Hz at 420Hz)

RECORD START TIME_____
RECORD START FREQUENCY_____

(e) Stop timing when Horn alarm sounds.

RECORD STOP TIME_____
RECORD STOP FREQUENCY_____

(f) Elapse time should be between 3 and 10 seconds. Horn alarm sounding. Under/over frequency indicator lighted.

(9) Step 9, Activate Initiate Switch S204 (S303, 400Hz)

(a) Press switch momentarily.
(b) Standby indicator remains lighted. No switching occurs.
(c) Request gradual return to 60Hz (400Hz). When frequency reading reaches 63Hz (400Hz reaches 418.5Hz)
(d) Horn alarm stops sounding. Under/over frequency indicator remains lighted.

(10) Step 10, Alarm Reset Malfunction Indicator Switch S201 (S301).

(a) [illegible]
(b) Under/over Frequency indicator extinguishes.

(11) Step 11, Activate Initiate Switch S204 (S303).

(a) Press Switch.
(b) Standby input is switched to active. Active input is switched to standby.

(12) Step 12, Activate Source Selector Switch S203 (S304).

(a) Set switch to original active source.

(13) Step 13, Activate Initiate switch S204 (S303).

(a) Press Switch.
(b) Original source becomes active. Testing source returns to standby.

(14) Step 14, 400Hz Control Panel.

Repeat steps 1 through 13 for 400Hz monitors using reading shown in ( ).

5. SUMMARY:

This Practical Exercise has been designed to provide you with the experience necessary to apply power, operate and perform test procedures [illegible] the Distribution and Switching Unit SA-1901. You should now be able to perform this operation safety and without assistance.

END

UNITED STATES ARMY
SIGNAL SCHOOL
FORT GORDON, GEORGIA

INFORMATION SHEET

MOTOR GENERATOR OPERATIONS PU-401 AND PU-495

102-F6/A05-IS-(1)

APPROVED: 18 SEP 78

This is a Signal School publication.

I. INTRODUCTION

An operational analyses of the PU-401/M and PU-495/G Diesel Engine Generators was presented in the classroom. The lesson also included a demonstration of the operational procedures. This lesson will apply the knowledge gained in the classroom by providing actual experience in operating the power generating equipment.

II. SAFETY

1. Personal Safety

   a. Voltages in this unit can cause DEATH by electrocution. Make certain that the equipment is properly grounded before use.

   b. Avoid smoking and open flame in the vicinity of the generator units.

   c. Do not attempt to open the generator doors while the unit is operating.

2. Equipment Safety

   a. The equipment contains protective devices to preclude damage to equipment during operation. Do not defeat protective circuits. Keep the EMERGENCY RUN switch OFF.

   b. Always perform prestart procedures before operating equipment.

III. OPERATION

1. Preliminary starting procedures - PU-401/M

   a. Check the following items and record their condition as satisfactory or unsatisfactory.

   (1) Fuel level — OK

   (2) Oil level — OK

   (3) Radiator coolant level — OK

   (4) Grounding terminal — OK

   (5) Visual inspection — OK

   (6) Battery water level — OK

b. Answer the following questions pertaining to the prestart procedures for the PU-401/M.

(1) The FUEL CONTROL valve is in the Aux position.

(2) Is this the correct position? yep.

2. Starting and operating procedures for the PU-401/M.

a. Perform the starting and operating procedures in sequence and record information as indicated.

(1) Check overspeed relay to be sure it is reset (behind first panel on right side of generator).

(2) Close all side panels.

(3) Open vent panels located below control panel.

(4) Place PARALLELING switch in OFF position.

(5) Place the ELECTRIC GOVERNOR switch in OFF position.

(6) Place REMOTE-LOCAL switch in the LOCAL position.

(7) Turn FREQUENCY CONTROL rheostat fully CCW, then CW approx, one-half turn.

(8) Turn VOLTAGE CONTROL rheostat fully CCW, then CW approximately one-half turn.

(9) Push Heater AIR VALVE IN and LOCK.

(10) Place PERMISSIVE START switch to START.

(11) Pull THROTTLE control OUT approximately HALFWAY and hold ENGINE START switch in START position.

(12) When engine starts, control speed at fast idle with throttle. Release start switch when oil pressure guage indicates above 25 psi.

(13) Push FLASH FIELD switch UP momentarily.

(14) When the voltage, indicated by the AC voltmeter, builds up place the GOVERNOR switch in the on position.

(15) When governor has taken over speed control, push THROTTLE IN and LOCK.

NOTE: If engine "oscillates", pull throttle out slowly until oscillations stop; then slowly push it back in all the way and lock.

(16) Adjust VOLTAGE CONTROL rheostat for proper output voltage.

(17) Record the output voltage: Between Phases: Phase 1 to 2 Phase 2-3; Phase 3-1.

(18) Adjust FREQUENCY CONTROL rheostat for proper frequency.

(19) Record the frequency 400

(20) Record the following engine gauge readings.

a. Oil pressure 57

b. Water temperature 130

c. Elapsed time 613.0

d. Ammeter (Battery charge current) _____

(21) Observe that all instruments indicate proper readings and that no unusual noise or vibration is apparent.

NOTE: Do not turn on output circuit breaker during this exercise.

b. Answer the following questions pertaining to the starting and operating procedures of the PU-401/M.

(1) The function of the Freq Control is to control the output frequency.

(2) Operating the Flashover switch enables the generator to produce AC voltage.

(3) To ↓ the output voltage turn the VOLTAGE CONTROL rheostat CCW.

(4) Are all instruments indicating the proper reading?

Yes

3. Shut-off procedures PU-401/M.

a. Perform the following procedures to turn off the power generating equipment.

(1) Verify that the OUTPUT CIRCUIT BREAKER is OFF.

(2) Pull THROTTLE OUT approximately HALFWAY and HOLD.

(3) Place ELECTRIC GOVERNOR in the OFF position.

(4) Push THROTTLE IN SLOWLY and LOCK.

(5) Place PERMISSIVE START switch in the OFF position.

b. Answer the following questions pertaining to shut down of the PU-401/M.

(1) The MAIN CIRCUIT BREAKER should be _____ before shutting down the generator.

(2) The THROTTLE gains control of engine speed when the _____ switch is in the _____ position.

(3) The control that shuts off the engine is the _____ _____ switch.

4. Preliminary starting procedures for PU-495/G.

a. Check the following items and record their condition as satisfactory or unsatisfactory.

(1) Fuel Level _____

(2) Oil Level _____

(3) Radiator coolant level _____

(4) Grounding terminal _____

(5) Visual inspection _____

(6) Battery water level _____

b. Answer the following questions pertaining to the prestart procedures for the PU-495/G.

(1) The FUEL CONTROL VALVE is in the _____ position.

(2) Is this the correct position? _____

5. Starting and operating procedures PU-495/G.

a. Perform the starting and operating procedures in sequence and record information as indicated.

(1) Open engine compartment vents.

(2) Place EMERGENCY RUN switch to OFF.

(3) Place UNIT OPERATION to SINGLE UNIT position.

(4) Place STARTING LOCATION switch in the LOCAL position.

(6) DEPRESS START switch.

NOTE: If engine does not start in 10-15 second release START switch and hold governor SPEED switch in up position for two seconds then depress START switch.

(7) When engine starts check and record.

a. Ammeter current 10

b. Oil pressure 55

c. Water temperature 140

d. Elapsed time indicator 6B-1

(8) Place FIELD FLASH switch up momentarily.

(9) When voltage, indicated by the AC voltmeter, builds up, adjust VOLTAGE rheostat for proper output voltage and record.

a. Output voltage 1-2 208

b. Output voltage 2-3 208

c. Output voltage 3-1 208

d. Output voltage 1-N 120

(10) Adjust the GOVERNOR SPEED control for proper output frequency and record 400.

NOTE: Do not turn on the main circuit breaker.

b. Answer the following questions pertaining to the starting and operating procedures of the PU-495/G.

(1) To reduce the output frequency operate the GOV control in a CCW direction.

(2) After the engine is started, what control must sometimes be operated in order to bring up the generator voltage?

Voltage cont

(3) Are all instruments indicating the proper reading?

Yes

6. Shut down procedures for PU-495/G.

a. Perform the following procedures to turn off the power generating equipment.

(1) Place the main CIRCUIT BREAKER in the OFF position.

(2) Reduce output frequency with the GOVERNOR SPEED control to approximately 50 Hz.

(3) Place the ENGINE CONTROL switch in the OFF position.

b. Answer the following questions pertaining to the shut down procedures for the PU-495/G.

(1) Before shutting down the generator the MAIN CIRCUIT BREAKER should be in the _____ position.

(2) Is it necessary to reduce the output voltage to minimum before shutting off the engine? _____

7. SUMMARY

This exercise has been designed to provide you with the practical experience necessary to start, operate, adjust and shut down the power generating equipment. At this time you should be capable of operating this equipment in the field.

UNITED STATES ARMY
SIGNAL SCHOOL
FORT GORDON, GEORGIA

DIAGRAM BOOKLET

SATCOM TERMINAL AN/TSC-54

FUNCTIONAL ILLUSTRATIONS

102-F6/A01-A68-D(2)

APPROVED: 11 MAY 78

This is a Signal School publication.

THIS DIAGRAM BOOKLET SUPERSEDES
102-F6/N01-N75-D(2), DATED 22 FEB 77

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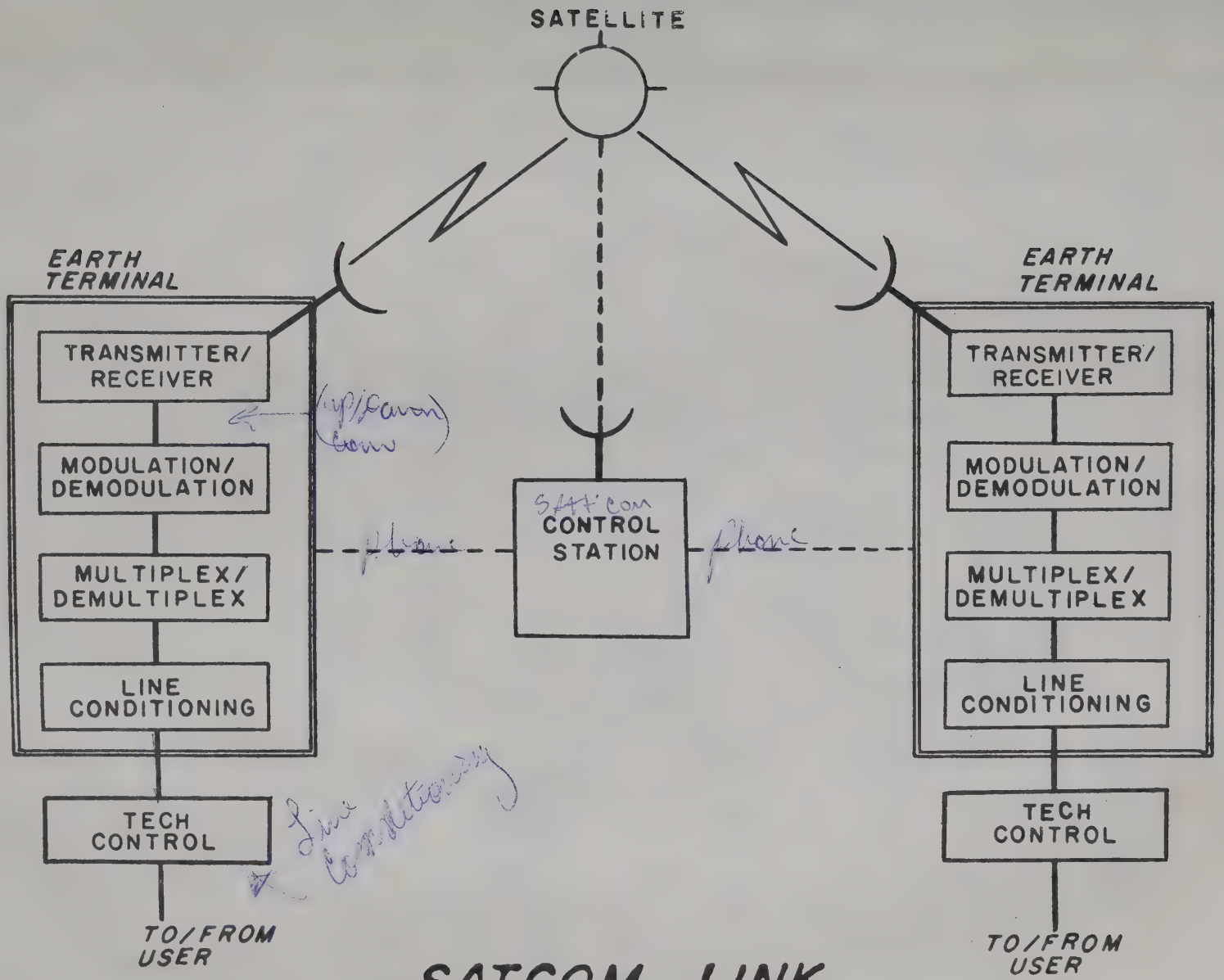
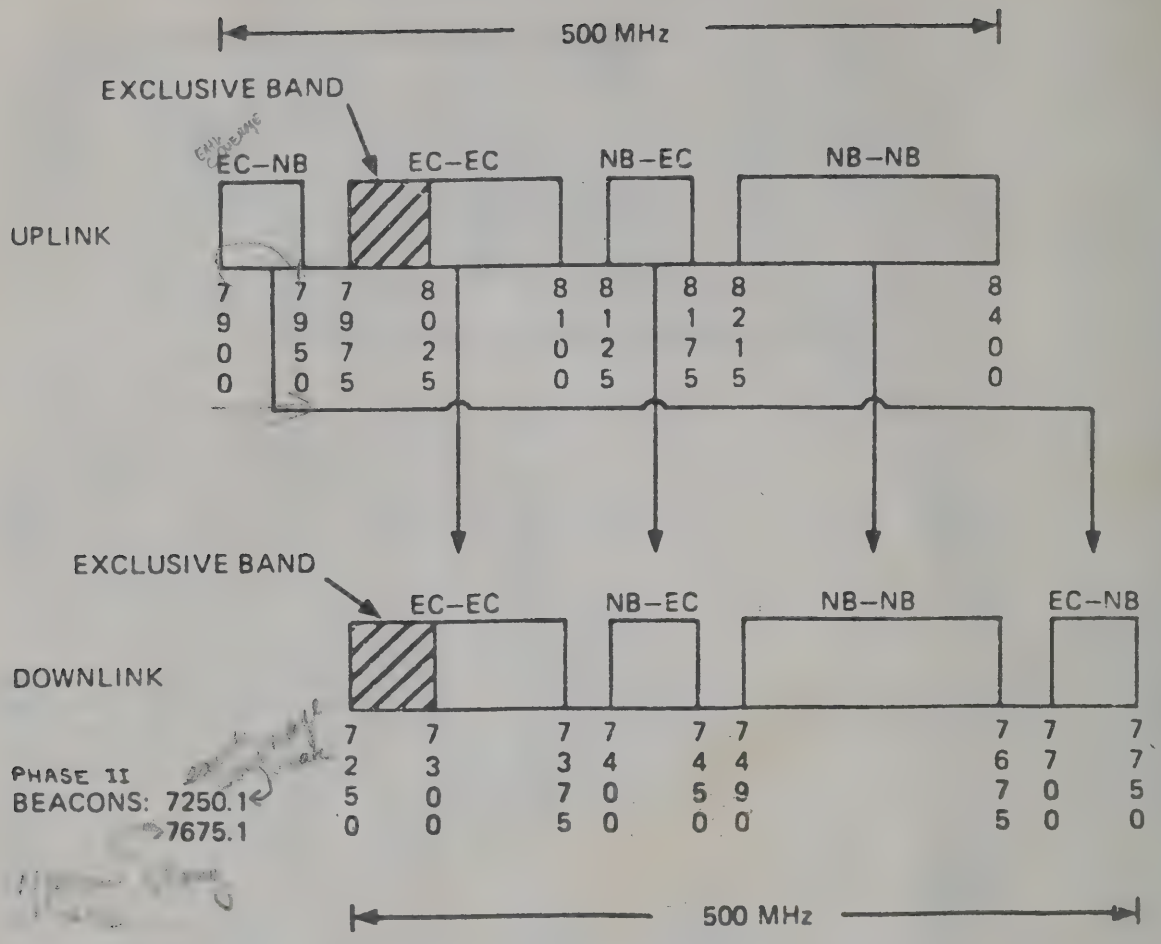
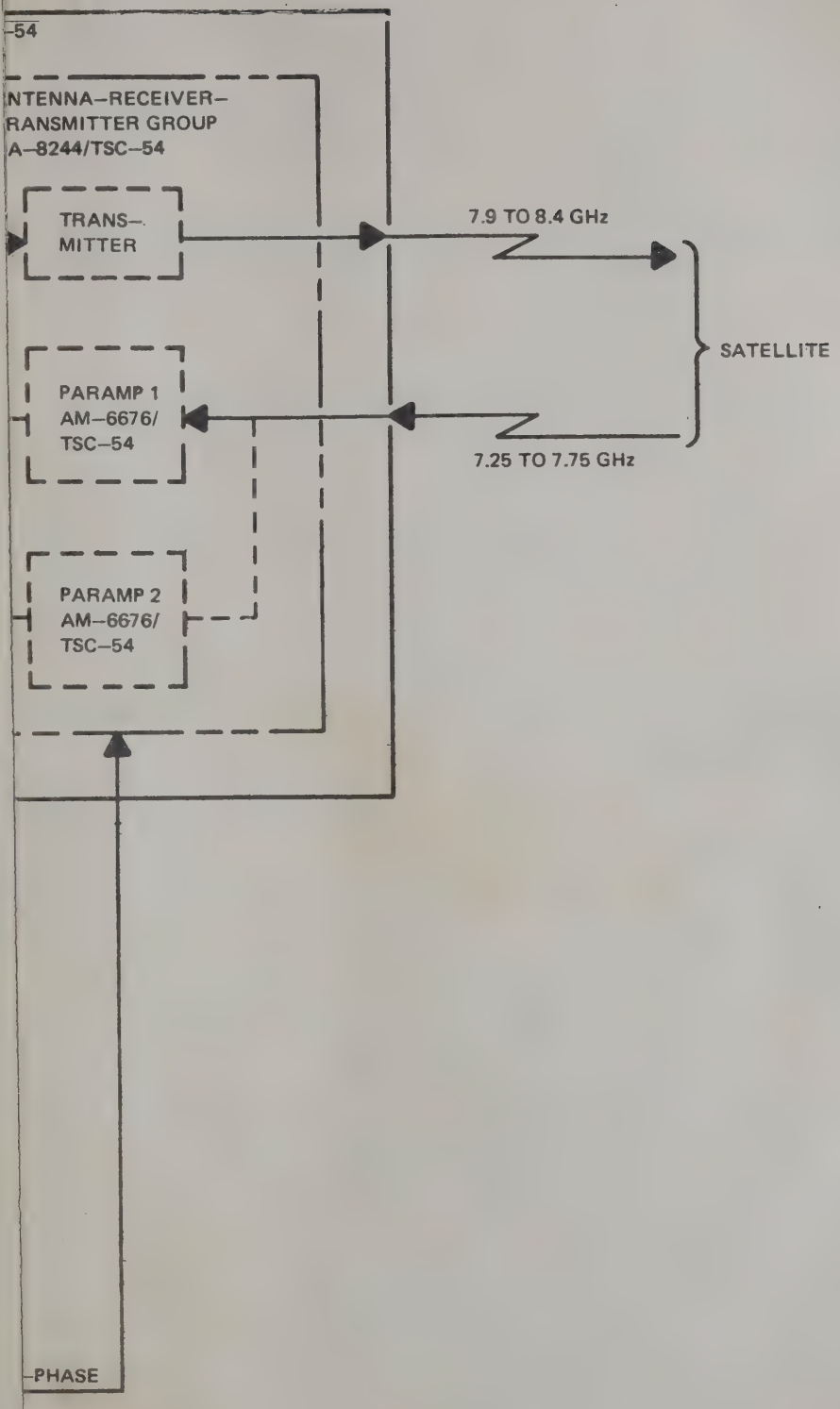

SATELLITE
EARTH TERMINAL
TRANSMITTER/ RECEIVER
MODULATION/ DEMODULATION
MULTIPLEX/ DEMULTIPLEX
LINE CONDITIONING
TECH CONTROL
TO/FROM USER
CONTROL STATION
EARTH TERMINAL
TRANSMITTER/ RECEIVER
MODULATION/ DEMODULATION
MULTIPLEX/ DEMULTIPLEX
LINE CONDITIONING
TECH CONTROL
TO/FROM USER

SATCOM LINK

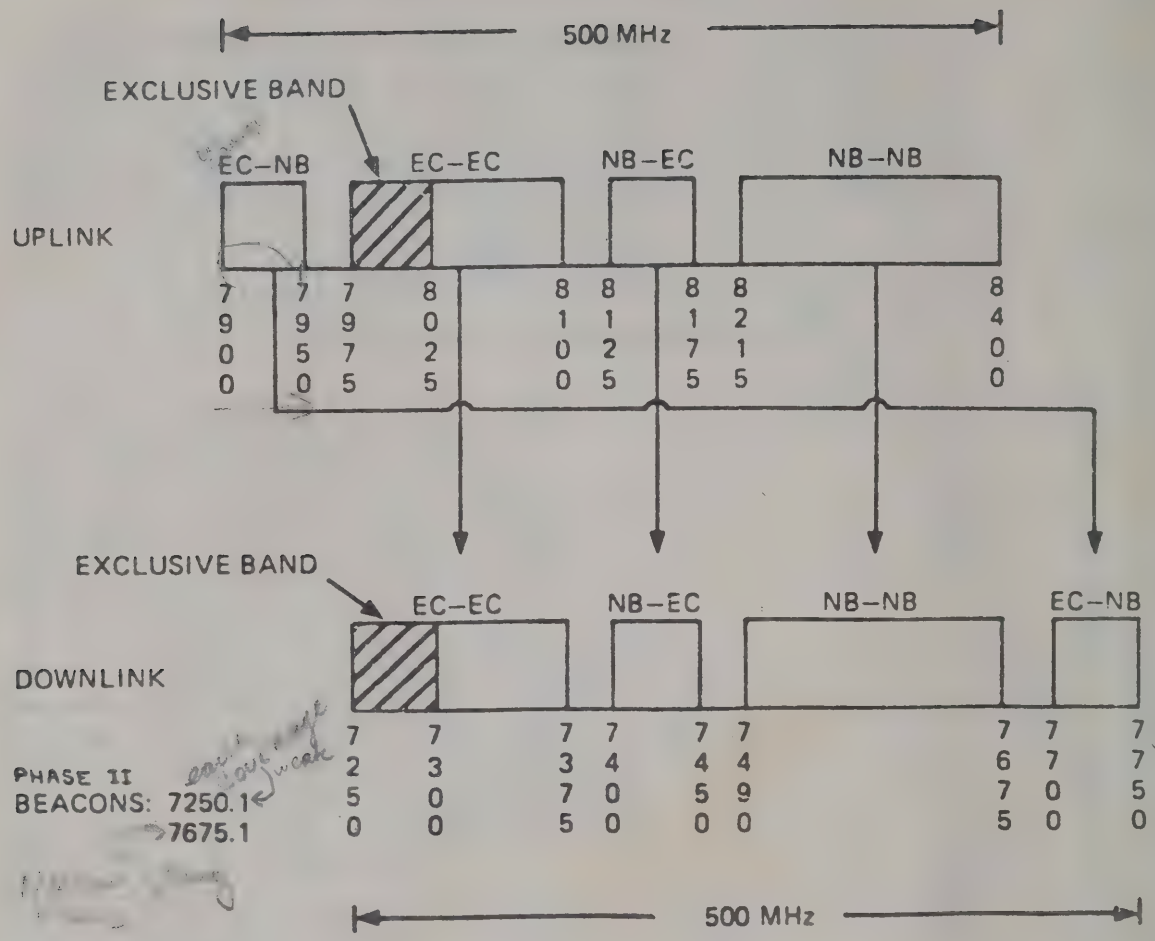


DSCS Phase II Satellite Frequency Translation Plan

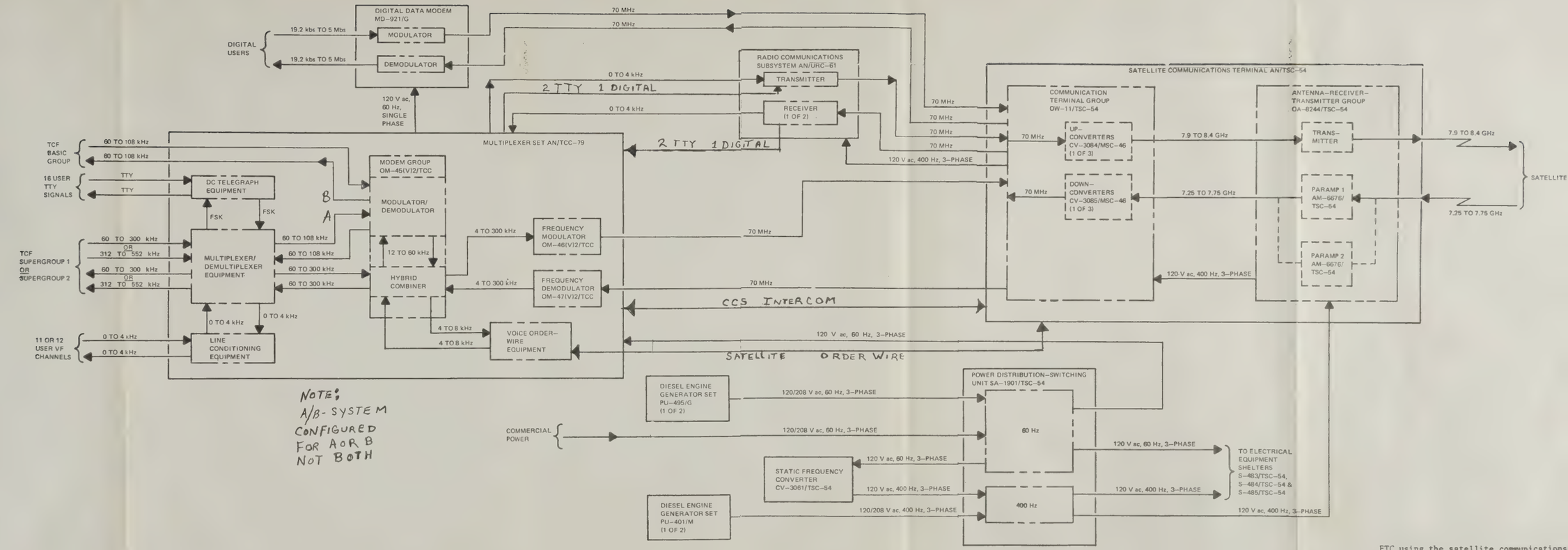


ETC using the satellite communications terminal AN/TSC-54, simplified block diagram

102-F6/A01-A68-D(2)

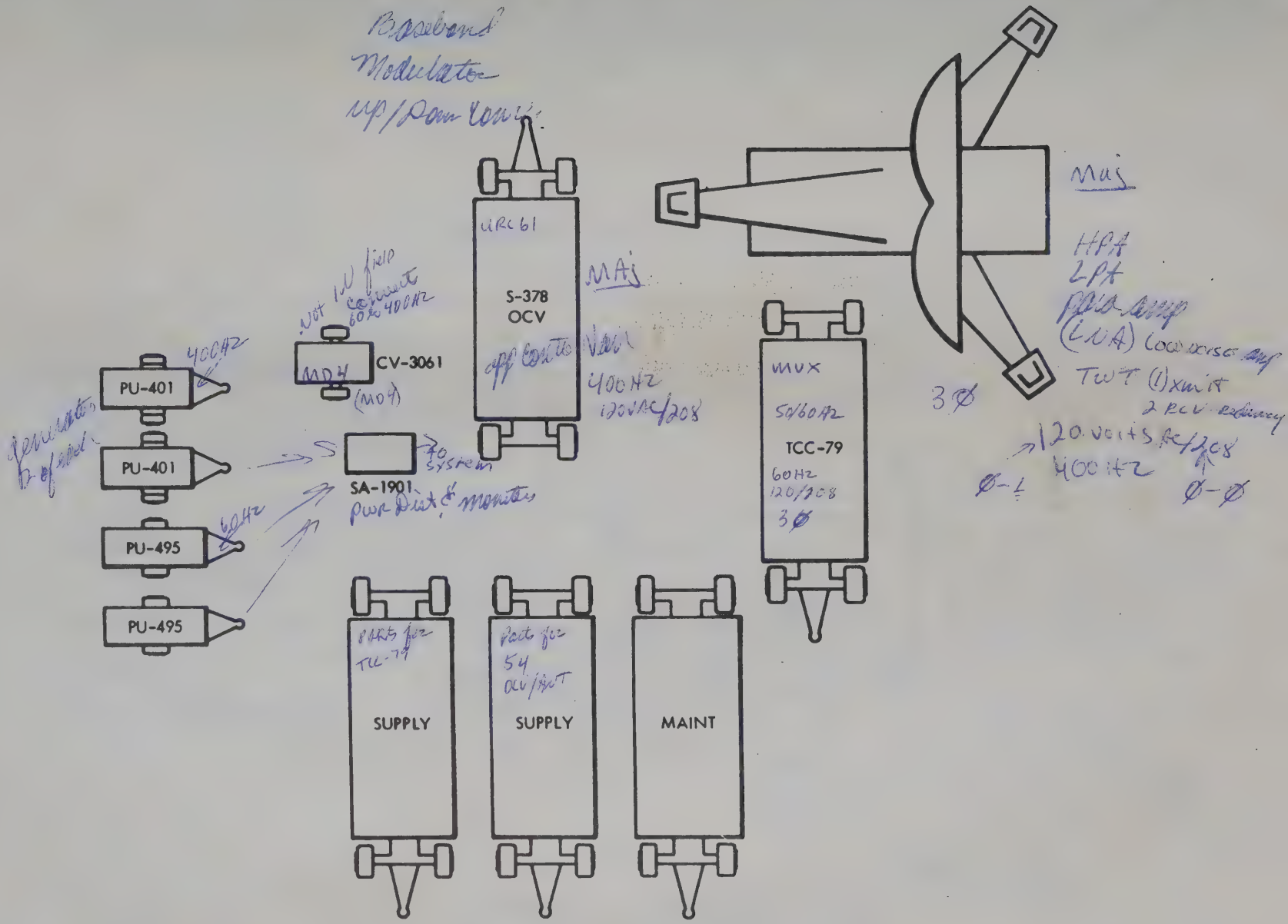


DSCS Phase II Satellite Frequency Translation Plan

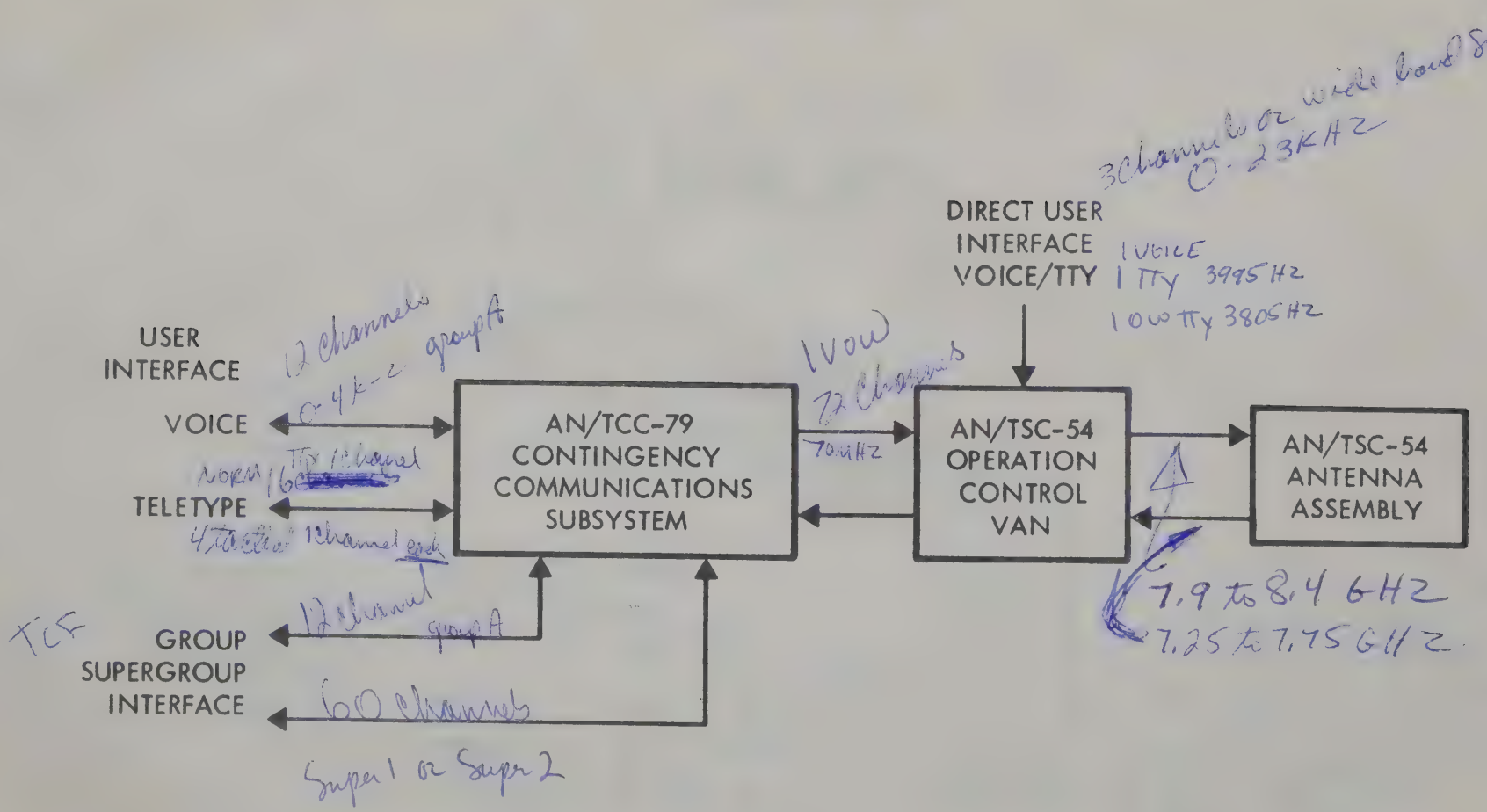


ETC using the satellite communications terminal AN/TSC-54, simplified block diagram

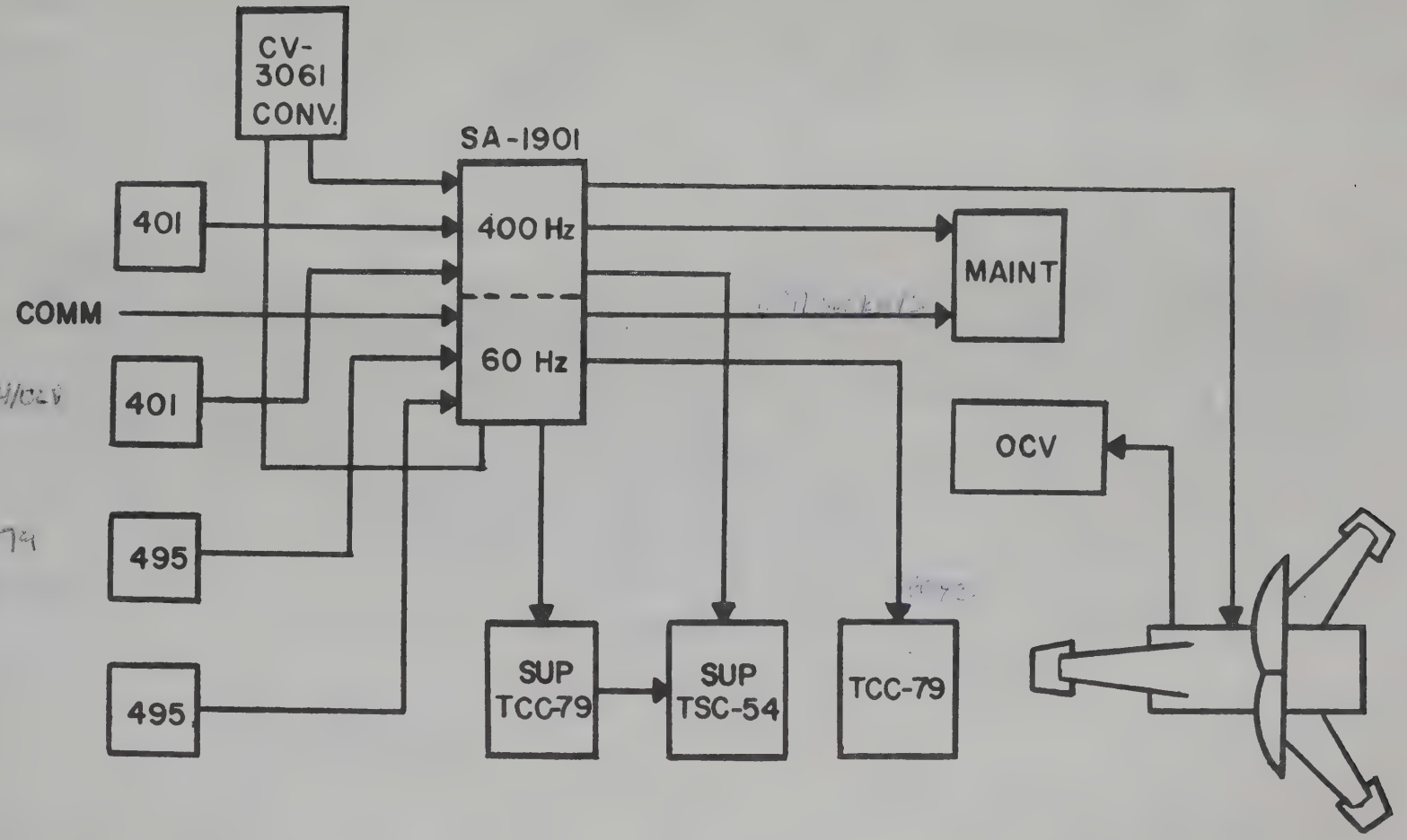
102-F6/A01-A68-D(2)



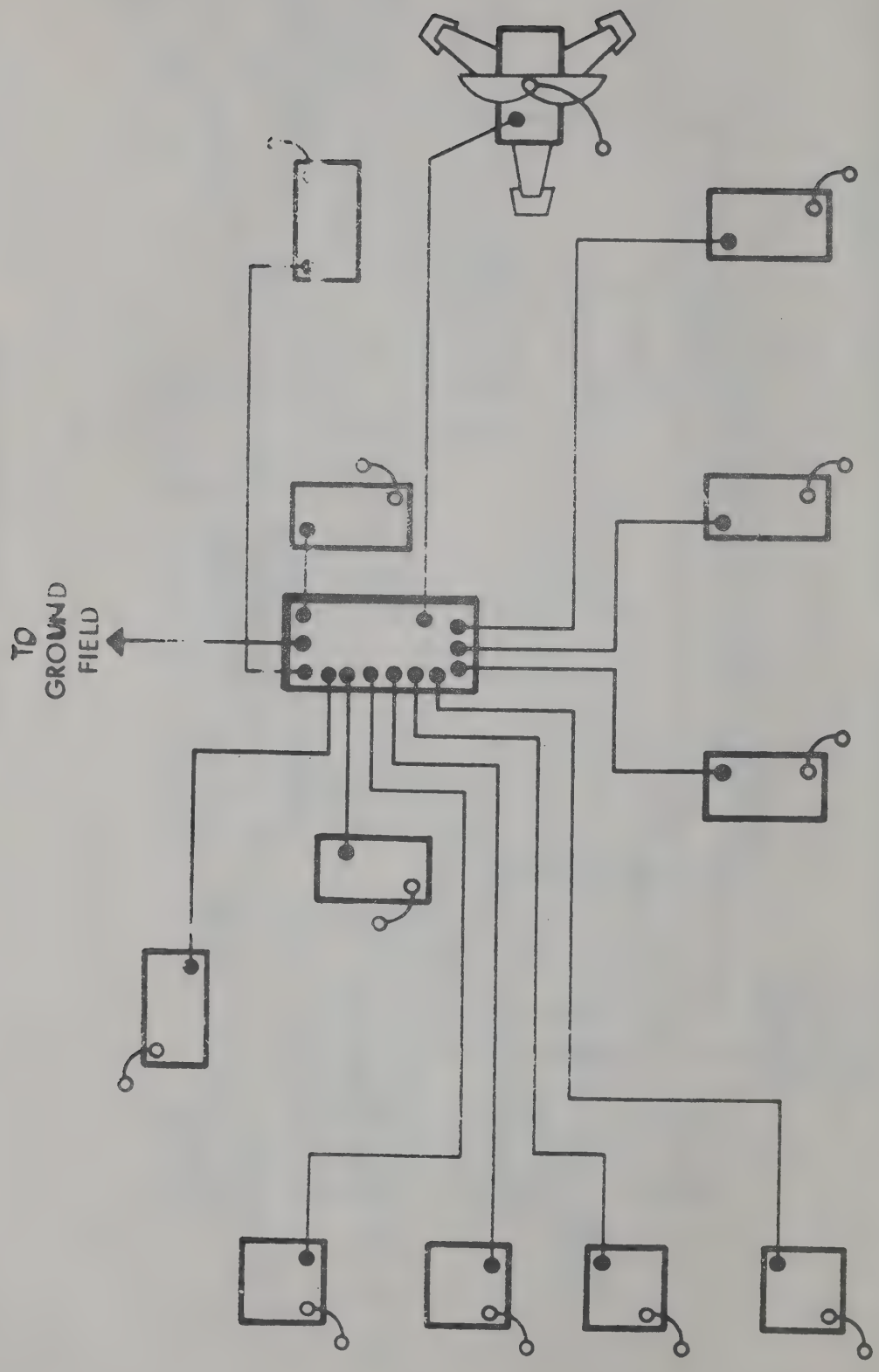
EARTH TERMINAL SUBSYSTEMS



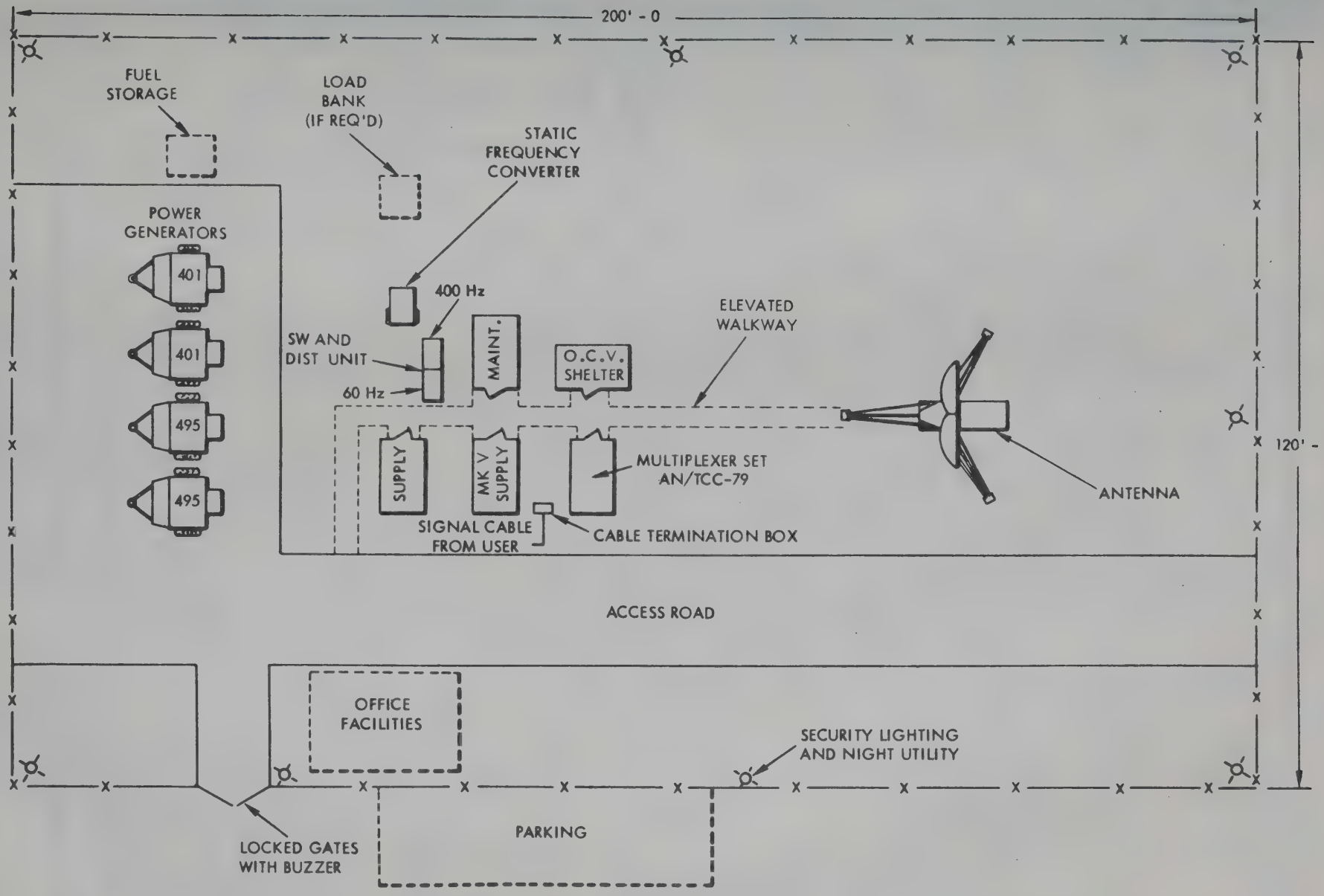
SUBSYSTEM SIGNAL INTERCONNECTION



POWER INTERCONNECTION

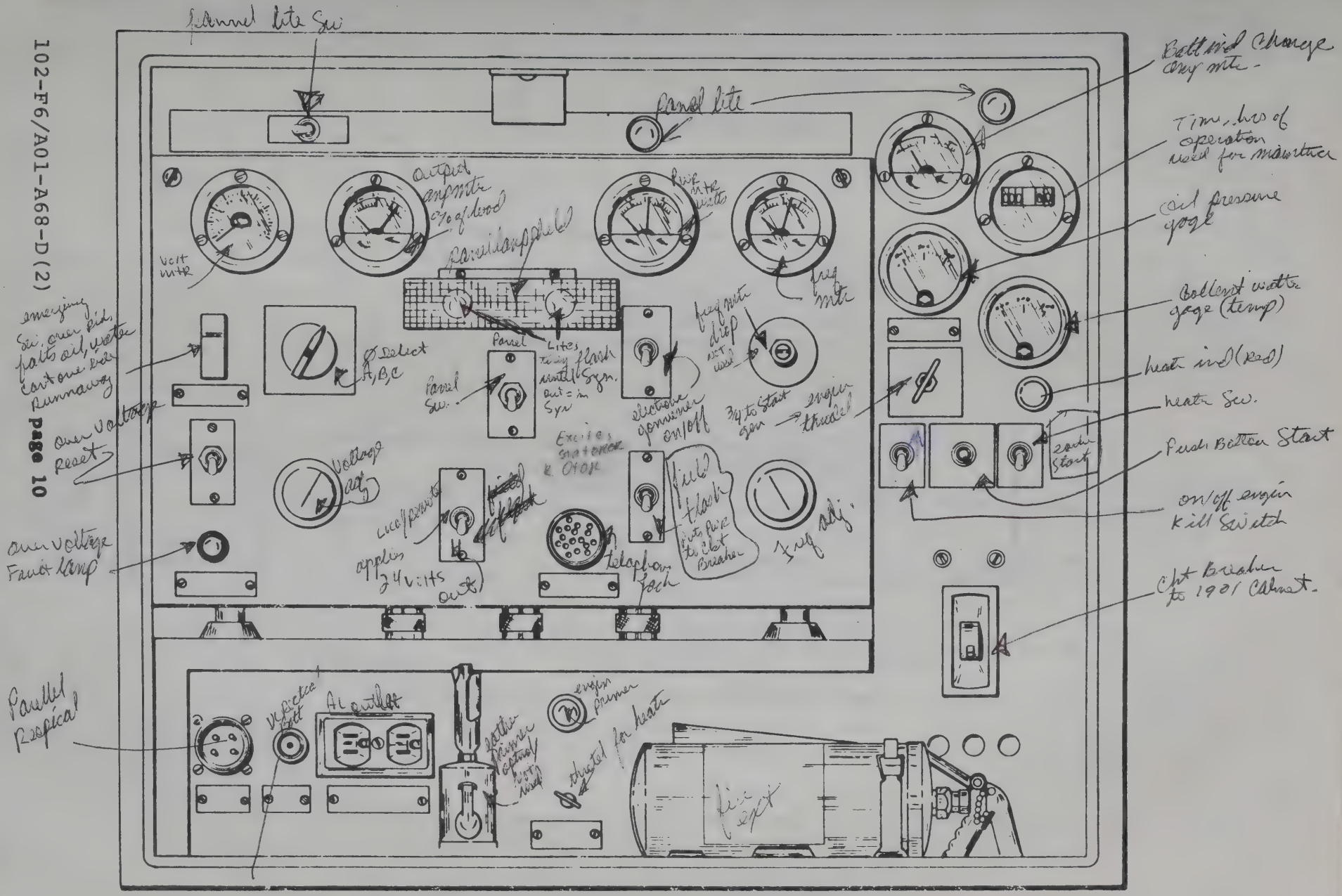


SYSTEM GROUNDING

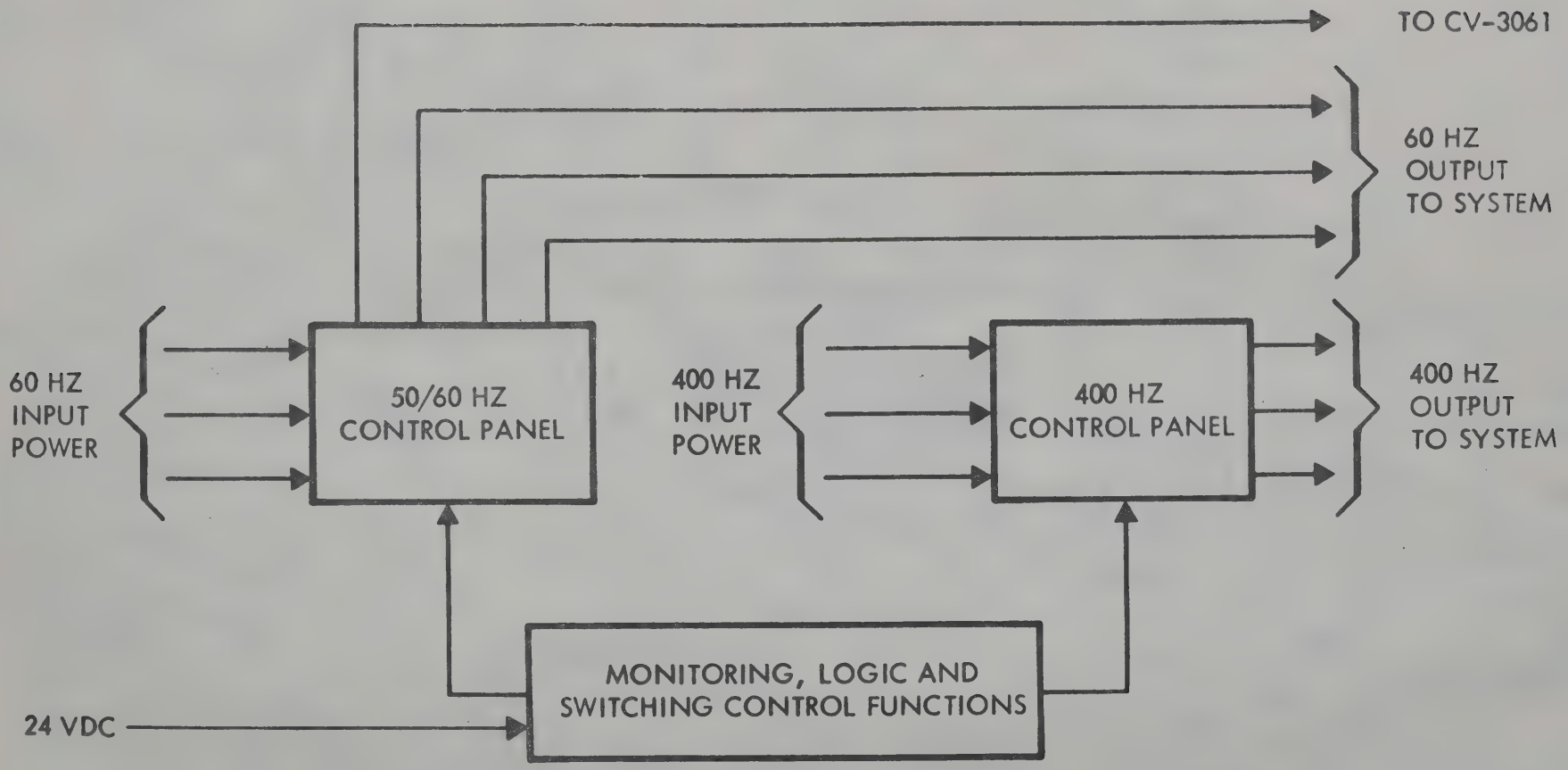


TYPICAL SITE PLAN

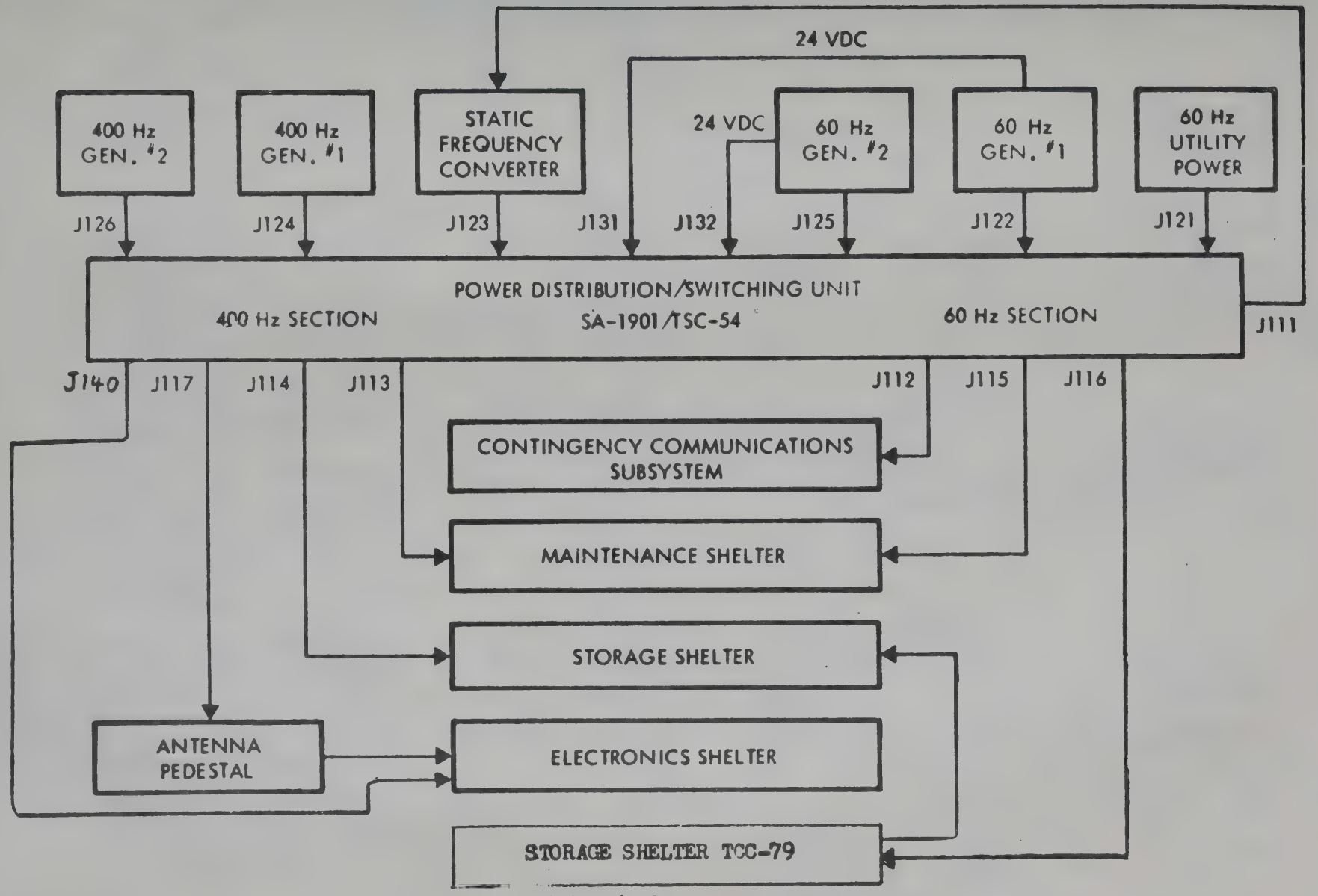
PU 495 GENERATOR CONTROL PANEL 60Hz



PU 401 GENERATOR CONTROL PANEL 400Hz

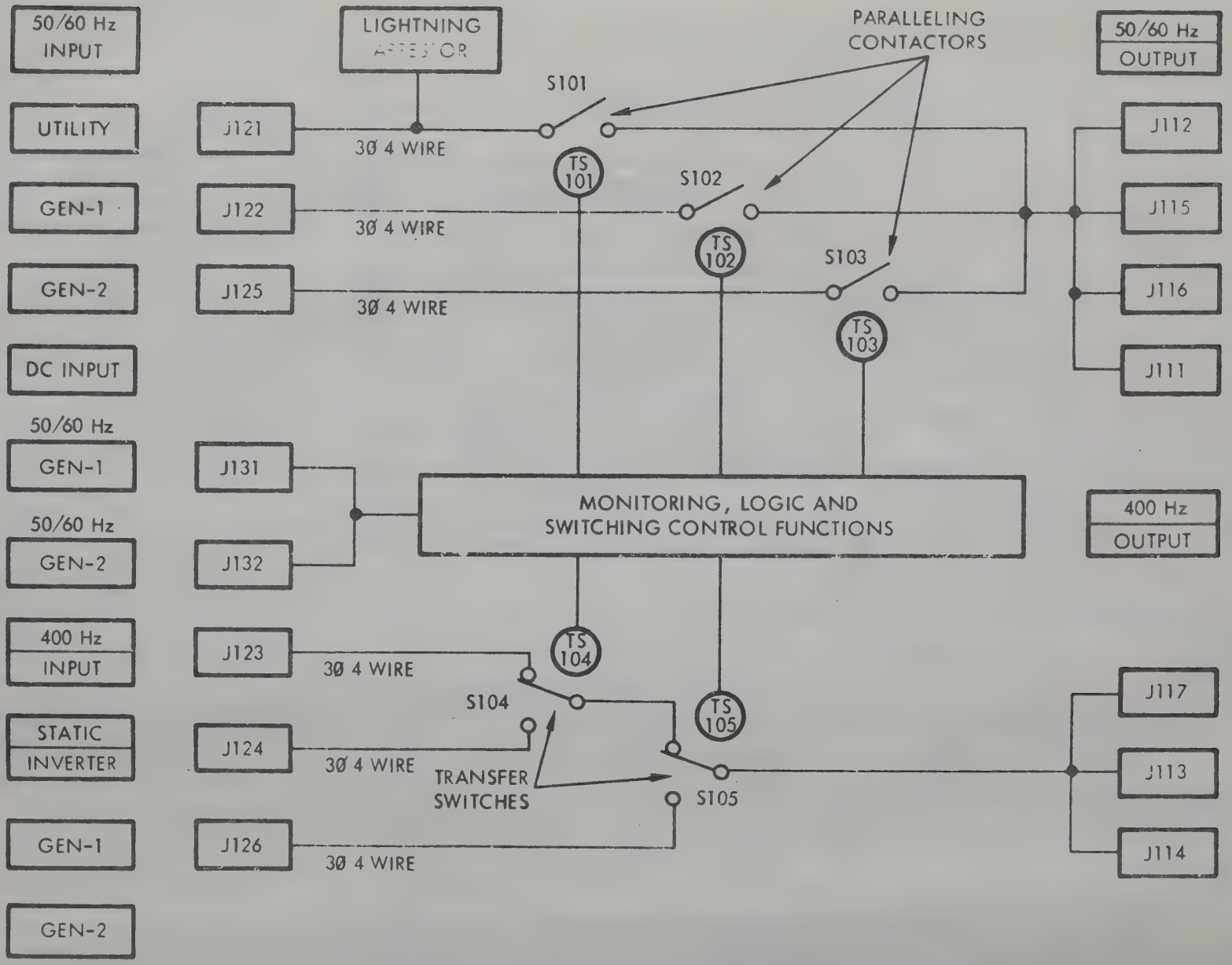


SA-1901 FUNCTIONAL AREAS

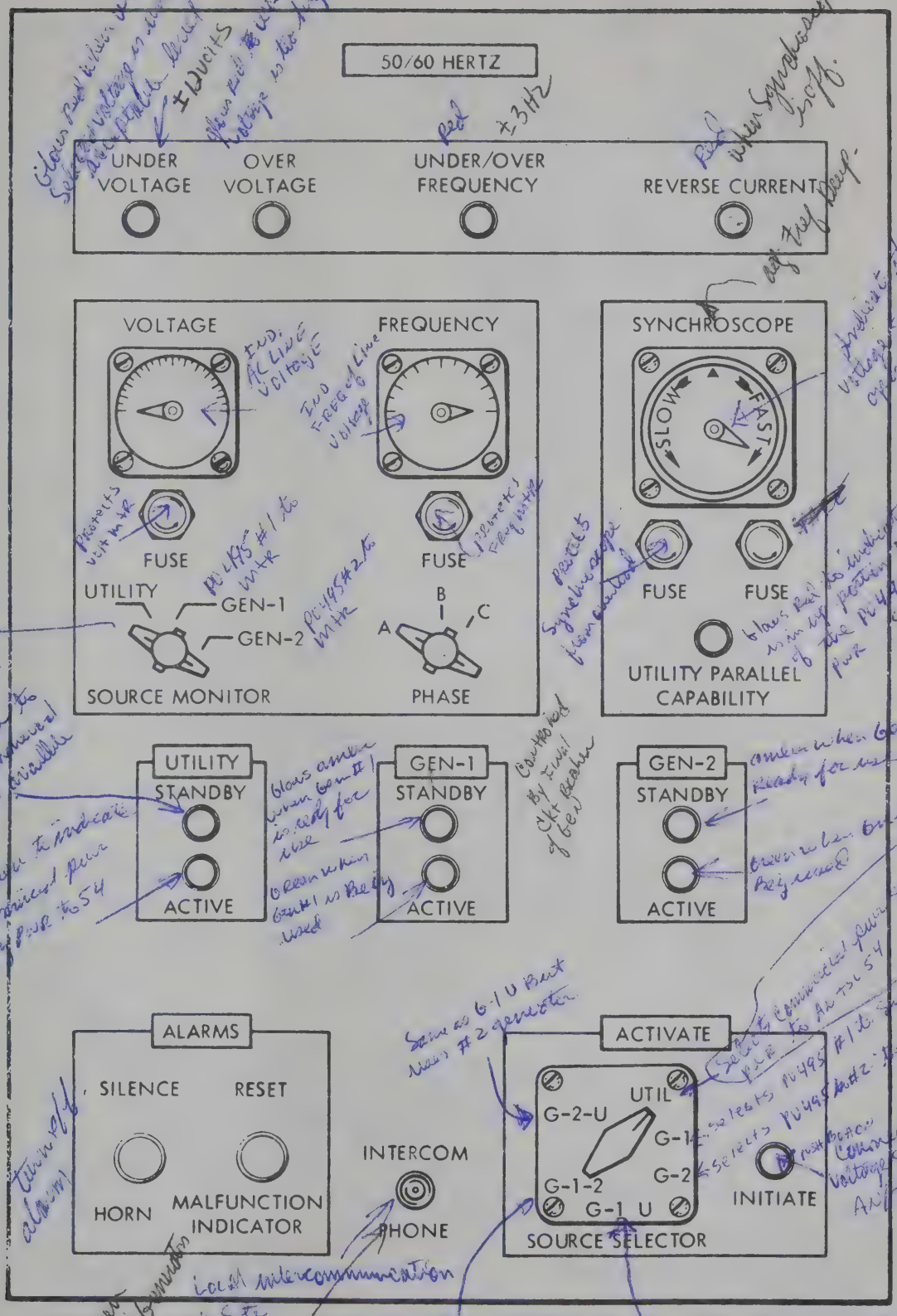


SA-1901/TSC-54 SYSTEM APPLICATION

TM 83-12
Page 3-10, 3-12



SA-1901/TSC-54 SIMPLIFIED BLOCK DIAGRAM



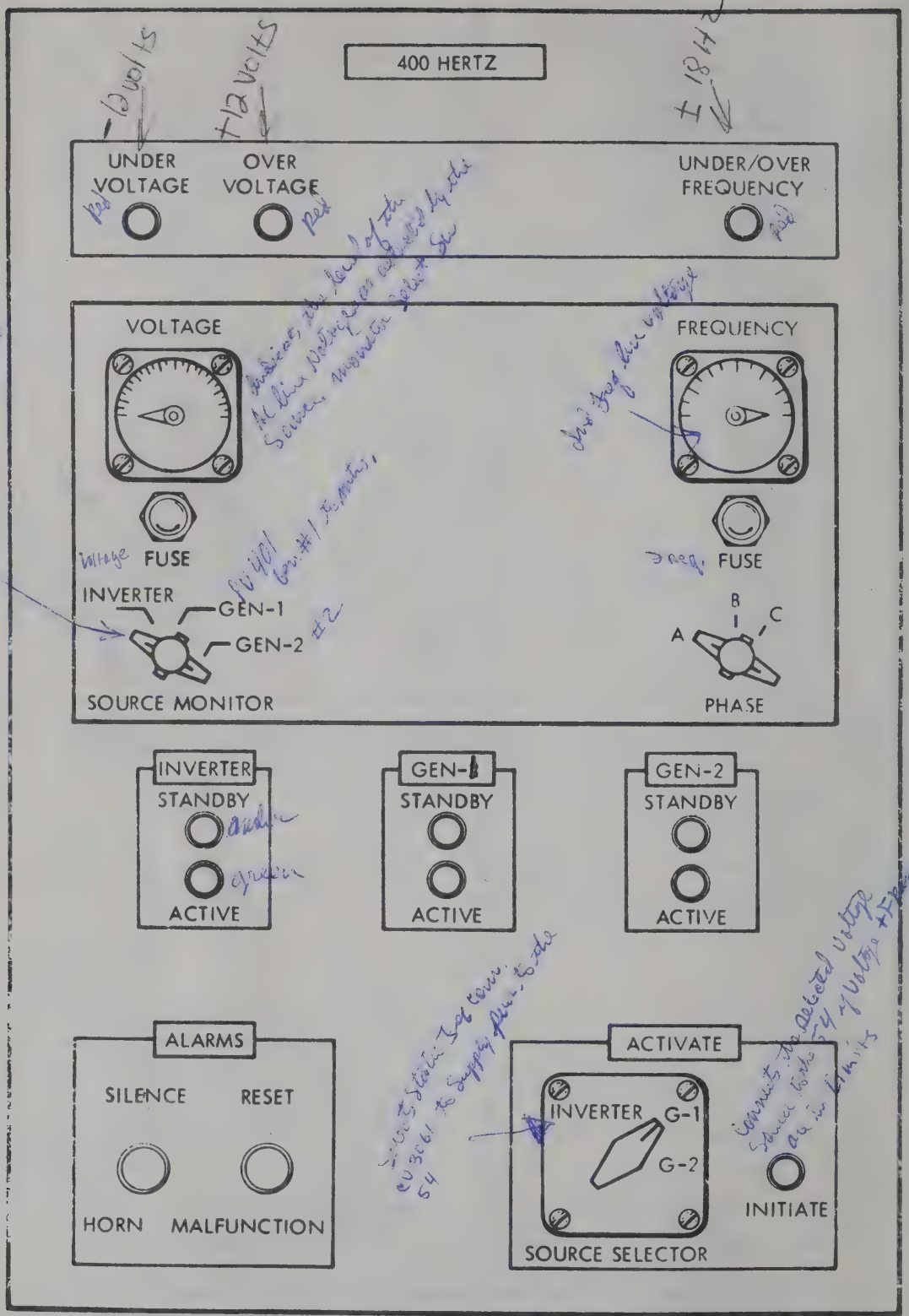
50/60 HZ CONTROL PANEL

TM 11-5895-753-12
P. 3-1 to 3-5

Selects parallel operation of PU495 gen #1 and commercial pwr source. Inhibit Sw S401 must be in the up position. Utility parallel capability ind lamp should light

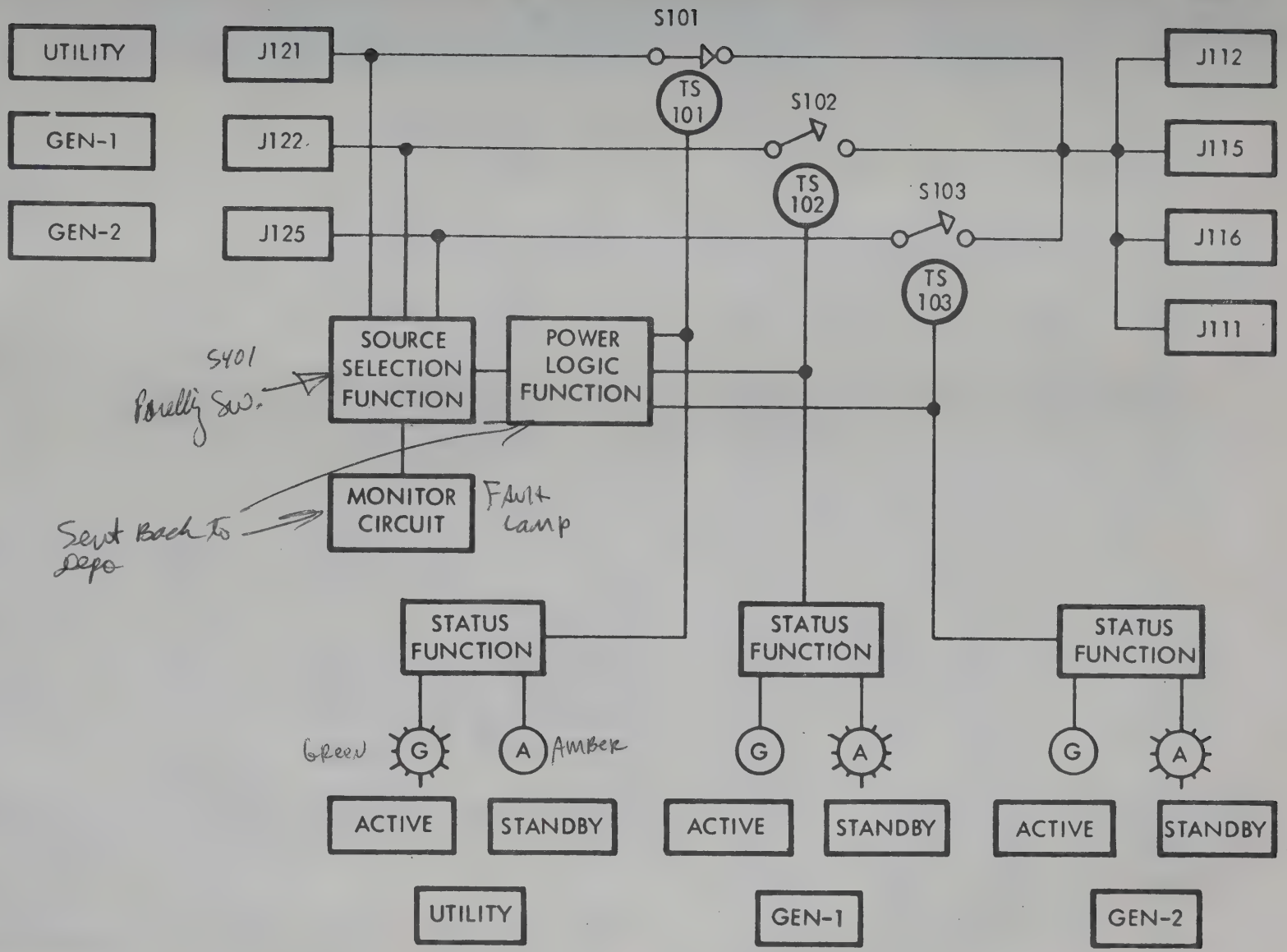
102-F6/A01-A68-D(2)

Dont parallel Gen with utility

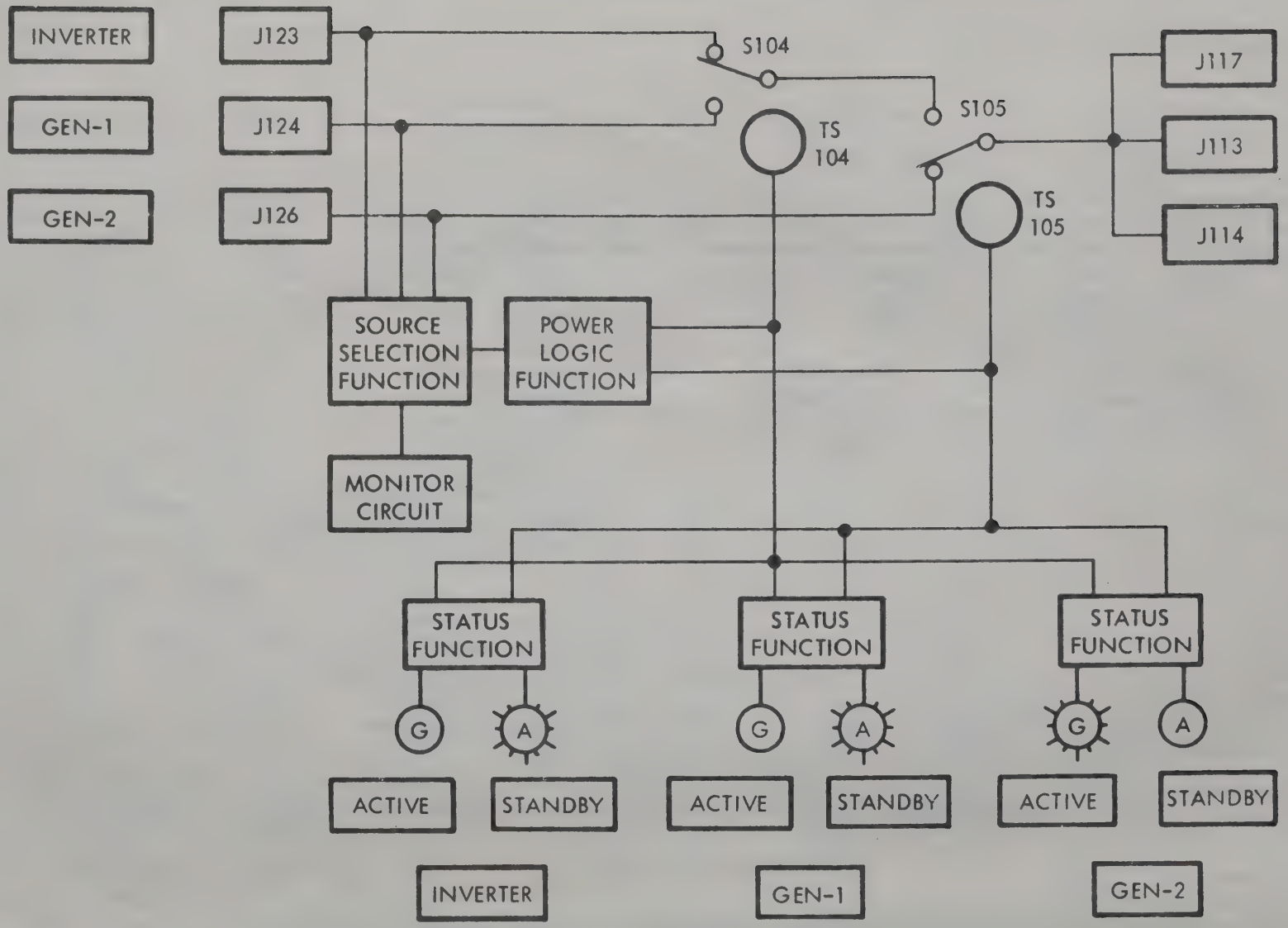


400 HZ CONTROL PANEL

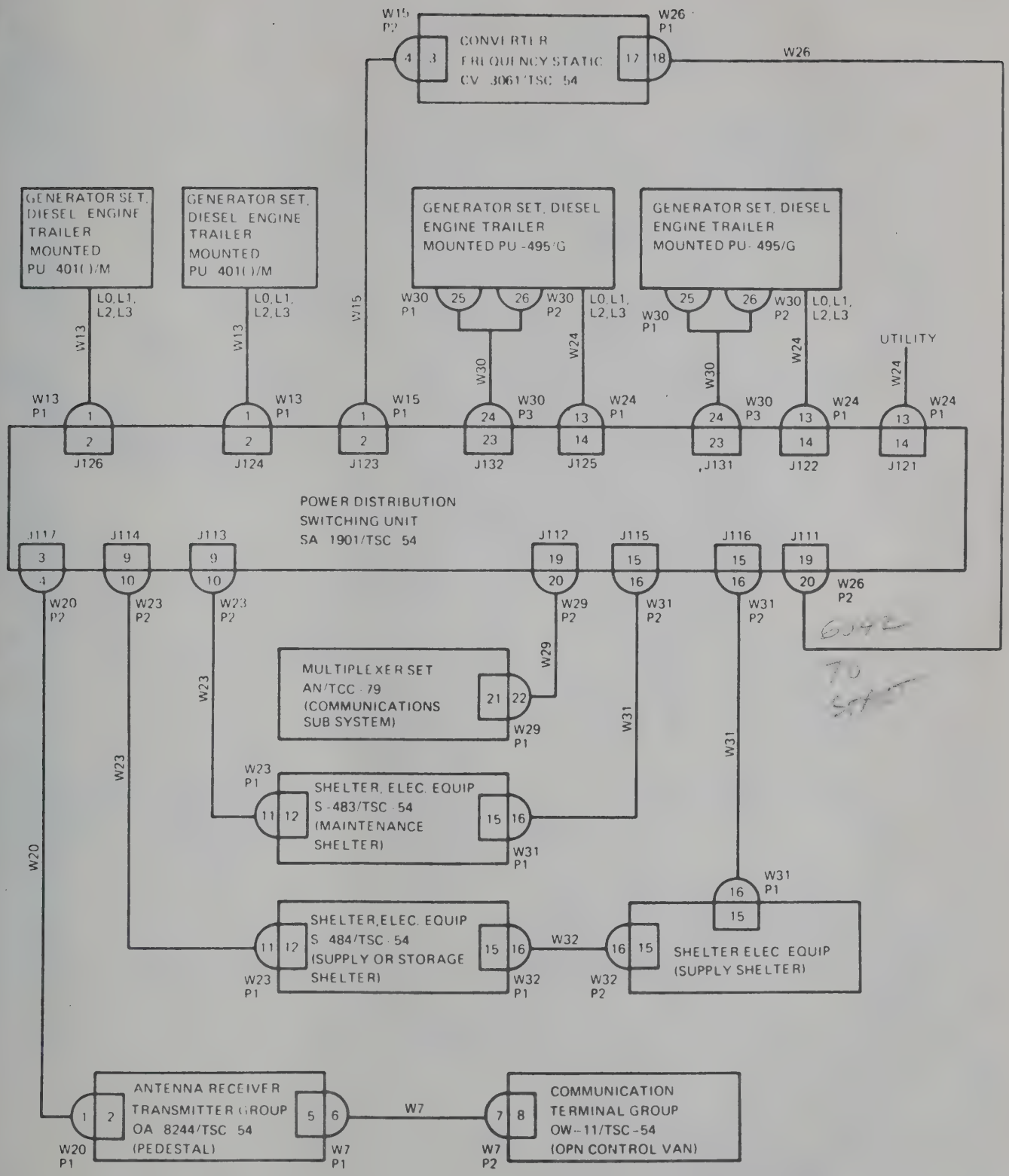
102-F6/A01-A68-D(2)



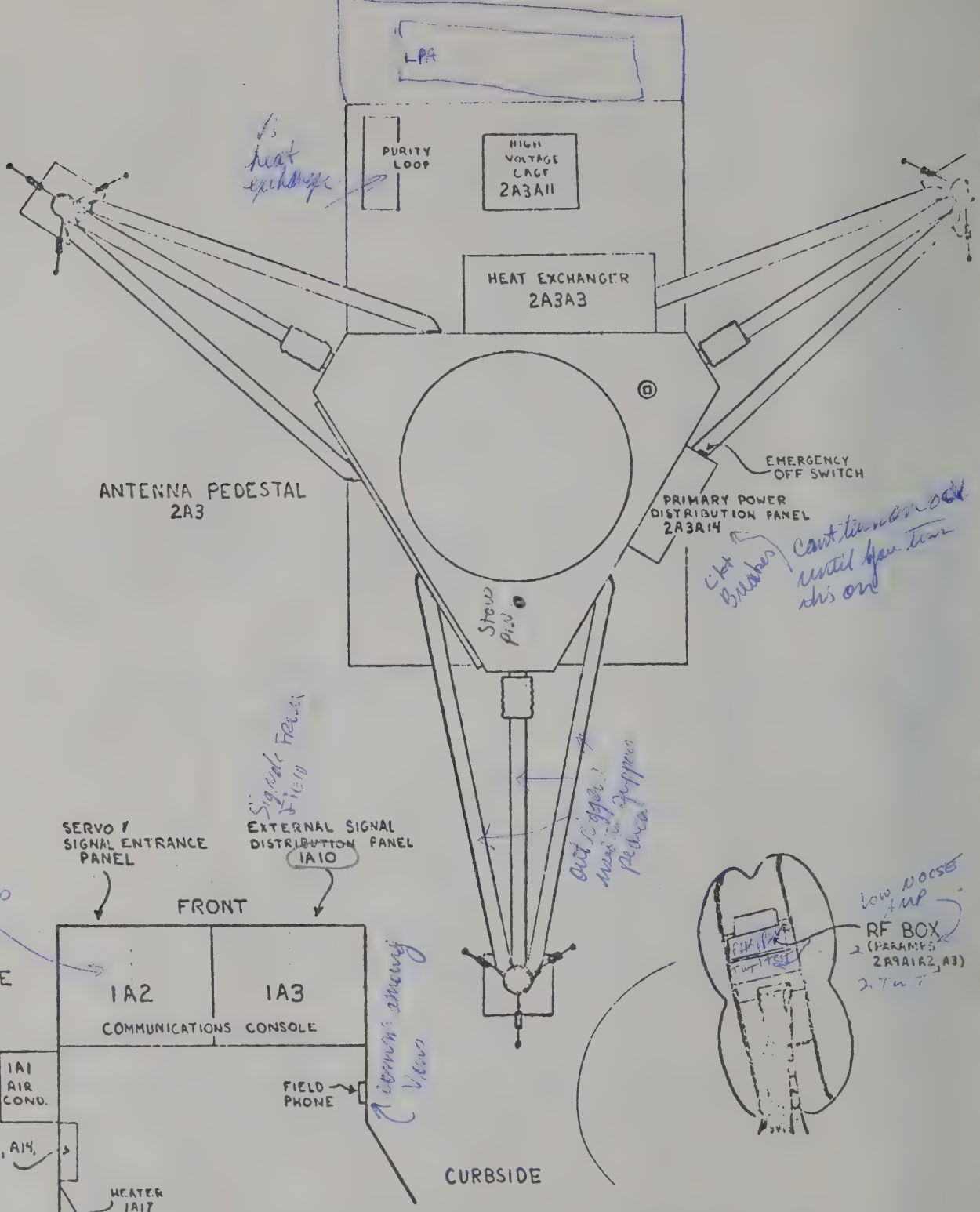
50/60 HZ STATUS INDICATION



400 HZ STATUS INDICATION


CONVERTER FREQUENCY STATIC CV 3061/TSC 54
GENERATOR SET, DIESEL ENGINE TRAILER MOUNTED PU 401( )/M
GENERATOR SET, DIESEL ENGINE TRAILER MOUNTED PU 401( )/M
GENERATOR SET, DIESEL ENGINE TRAILER MOUNTED PU-495/G
GENERATOR SET, DIESEL ENGINE TRAILER MOUNTED PU-495/G
UTILITY
POWER DISTRIBUTION SWITCHING UNIT SA 1901/TSC 54
MULTIPLEXER SET AN/TCC-79 (COMMUNICATIONS SUB SYSTEM)
SHELTER, ELEC. EQUIP S-483/TSC-54 (MAINTENANCE SHELTER)
SHELTER, ELEC. EQUIP S-484/TSC-54 (SUPPLY OR STORAGE SHELTER)
SHELTER ELEC EQUIP (SUPPLY SHELTER)
ANTENNA RECEIVER TRANSMITTER GROUP OA 8244/TSC 54 (PEDESTAL)
COMMUNICATION TERMINAL GROUP OW-11/TSC-54 (OPN CONTROL VAN)
TO SHT

AN/TSC-54 Power Complex Diagram

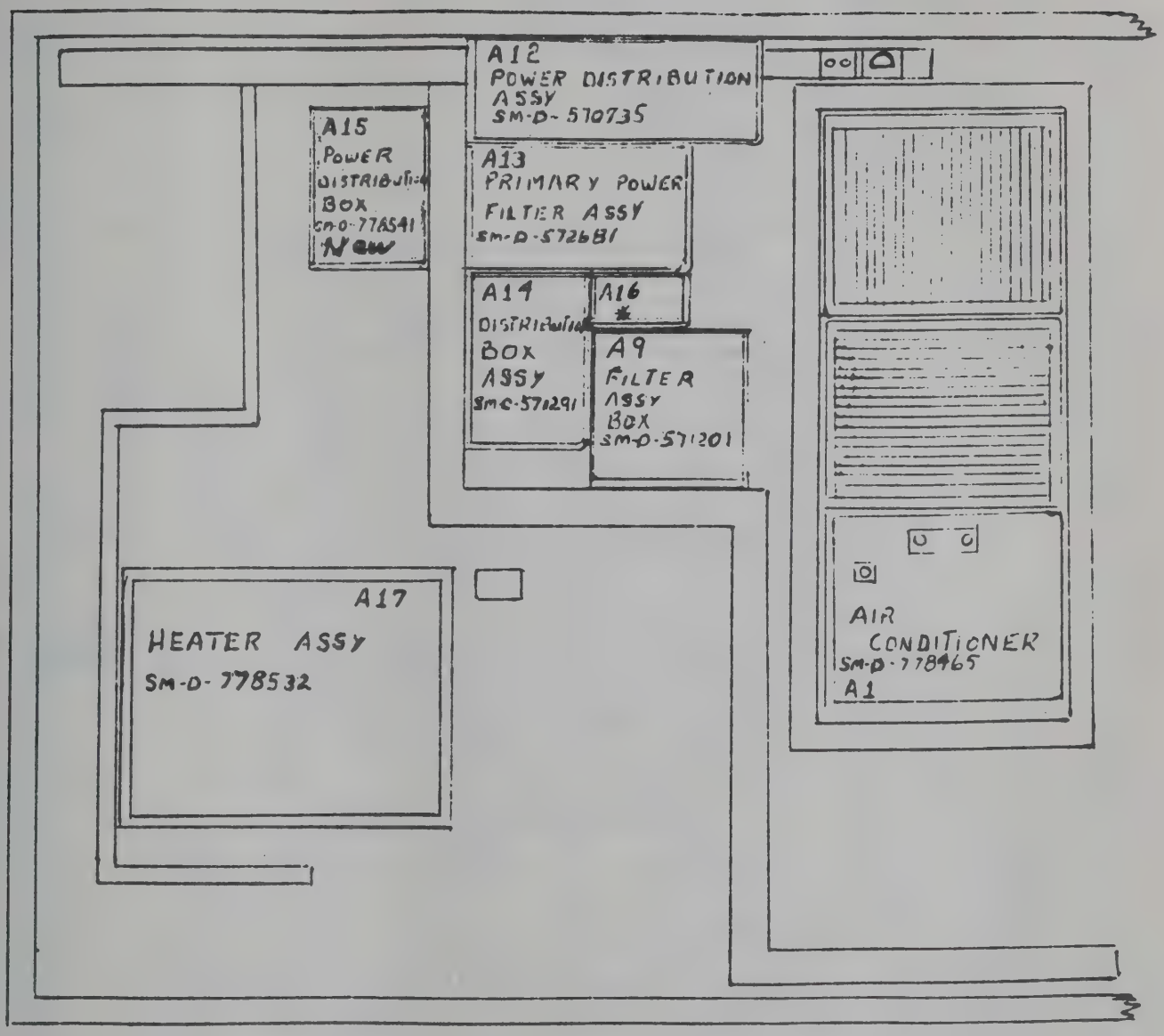


OPERATIONS CONTROL VAN (OCV)

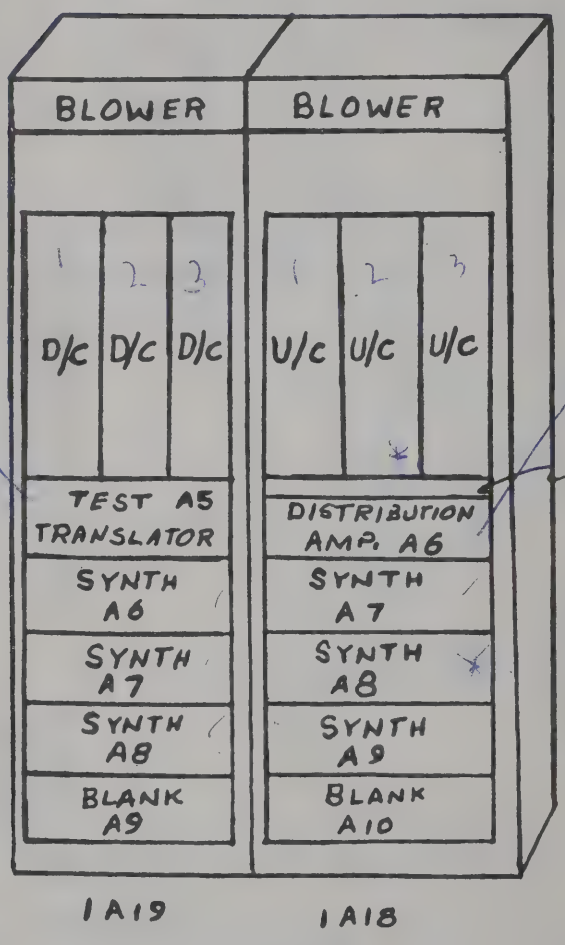
ANTENNA ASSEMBLY, OCV LAYOUT

102-F6/A01-A68-D(2)

SHELTER

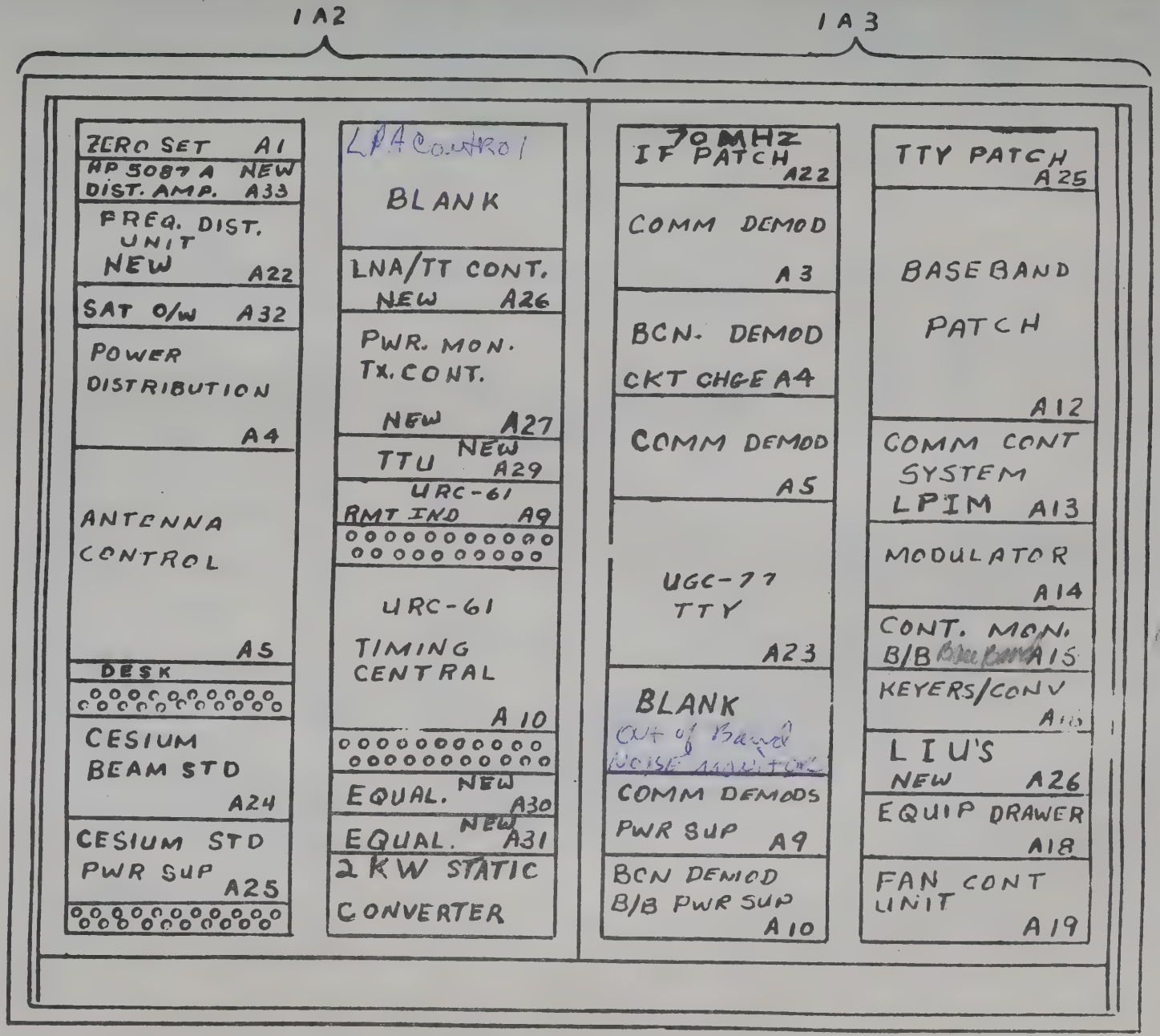


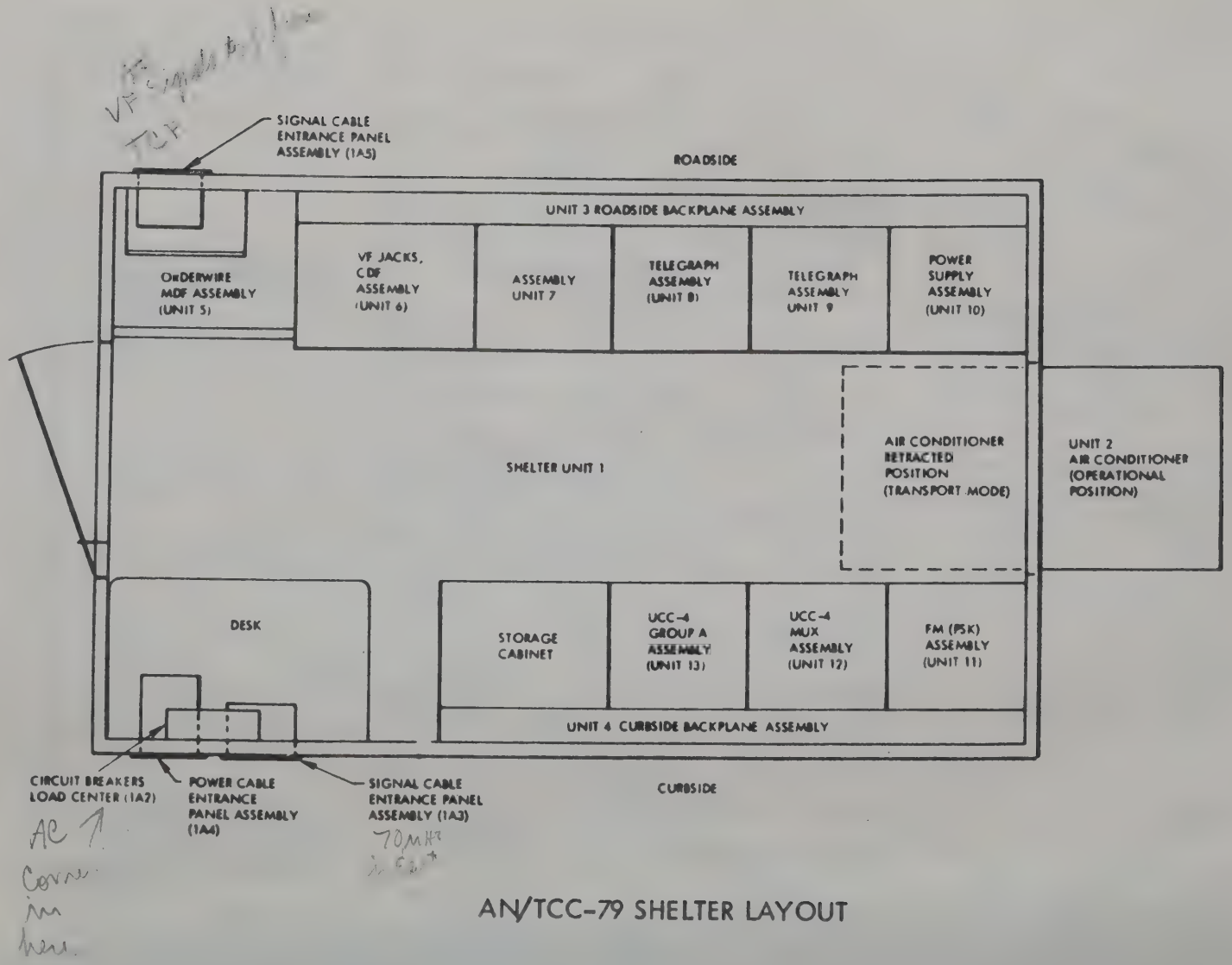
*A16 -- PRIMARY POWER MONITOR - SM-D-571085



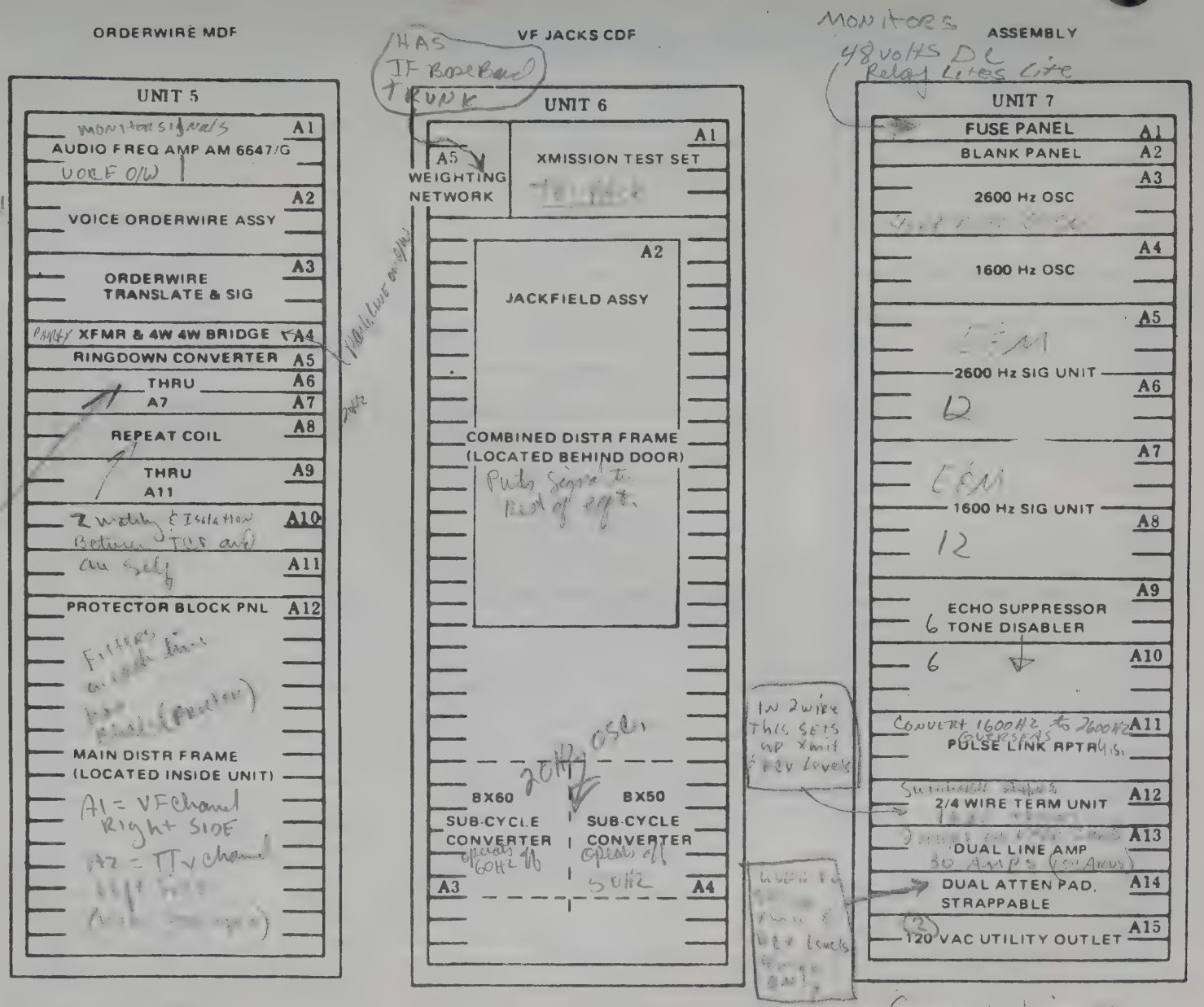
UP/DOWN CONVERTER
RACK ELEVATION

OCV CONSOLE ELEVATION

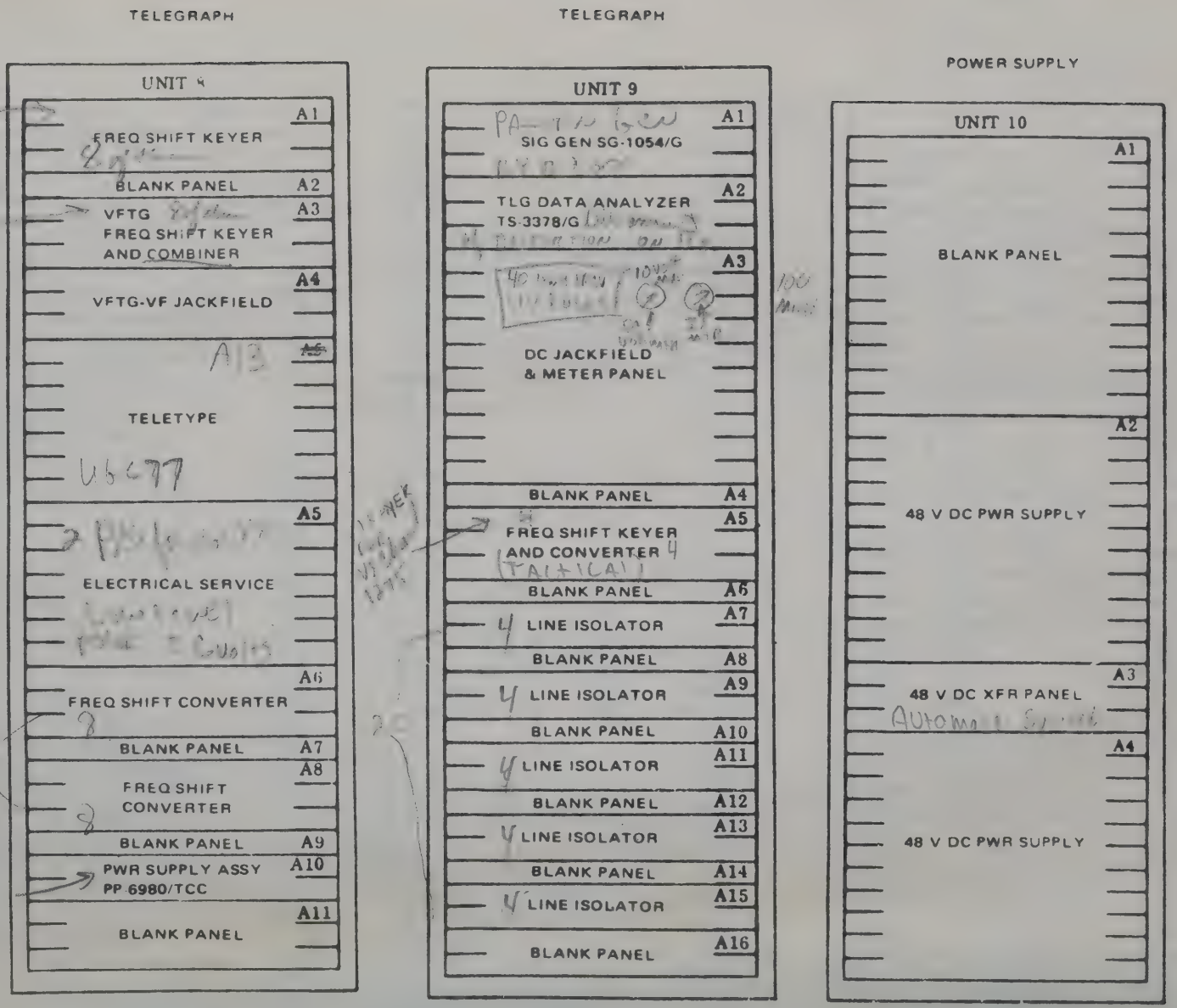



SIGNAL CABLE ENTRANCE PANEL ASSEMBLY (1A5)
ROADSIDE
UNIT 3 ROADSIDE BACKPLANE ASSEMBLY
ORDERWIRE MDF ASSEMBLY (UNIT 5)
VF JACKS, CDF ASSEMBLY (UNIT 6)
ASSEMBLY UNIT 7
TELEGRAPH ASSEMBLY (UNIT 8)
TELEGRAPH ASSEMBLY UNIT 9
POWER SUPPLY ASSEMBLY (UNIT 10)
AIR CONDITIONER RETRACTED POSITION (TRANSPORT MODE)
UNIT 2 AIR CONDITIONER (OPERATIONAL POSITION)
SHELTER UNIT 1
DESK
STORAGE CABINET
UCC-4 GROUP A ASSEMBLY (UNIT 13)
UCC-4 MUX ASSEMBLY (UNIT 12)
FM (PSK) ASSEMBLY (UNIT 11)
UNIT 4 CURBSIDE BACKPLANE ASSEMBLY
CIRCUIT BREAKERS LOAD CENTER (1A2)
POWER CABLE ENTRANCE PANEL ASSEMBLY (1A4)
SIGNAL CABLE ENTRANCE PANEL ASSEMBLY (1A3)
CURBSIDE

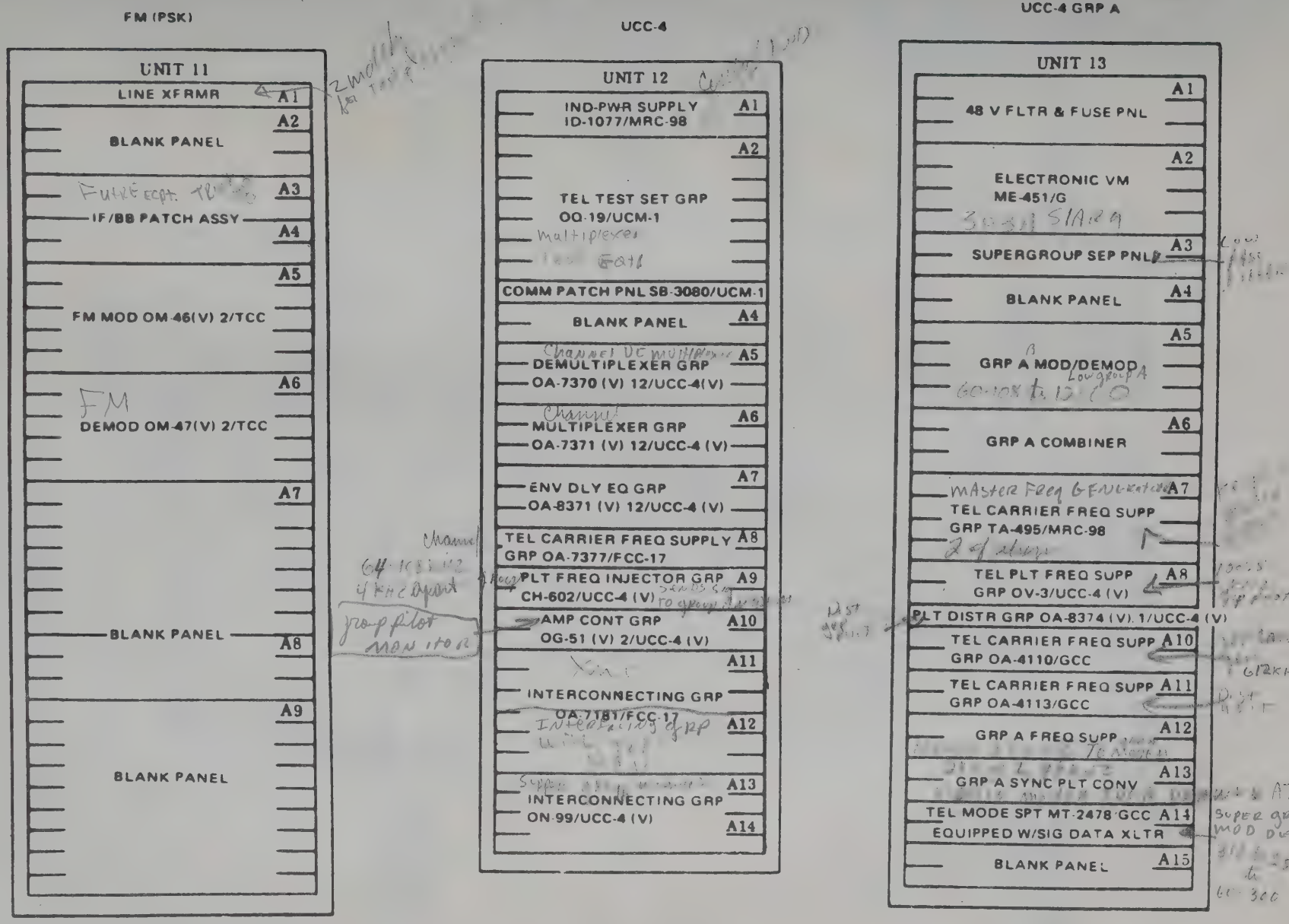
AN/TCC-79 SHELTER LAYOUT



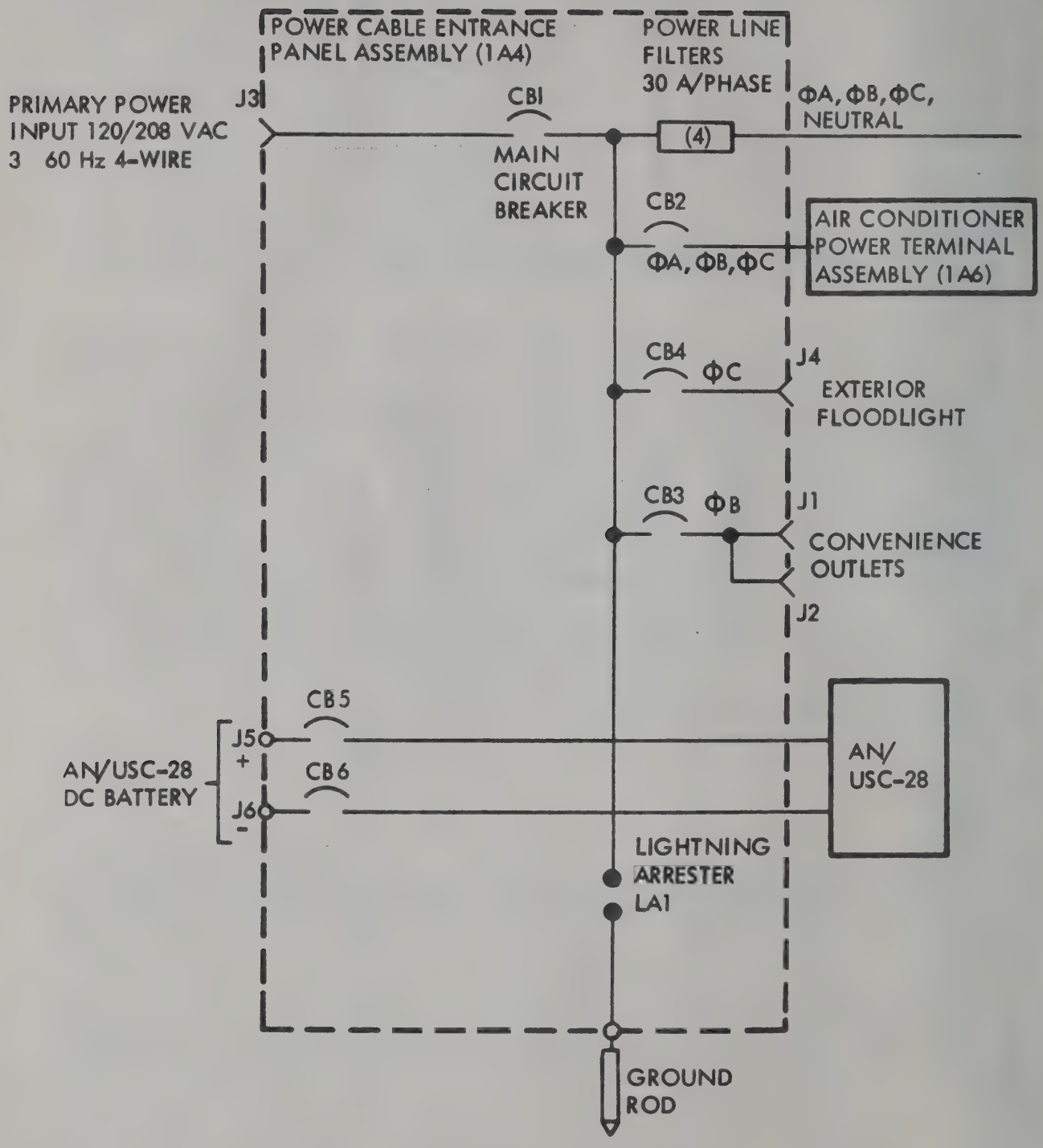
AN/TCC-79 ROADSIDE RACK ELEVATIONS



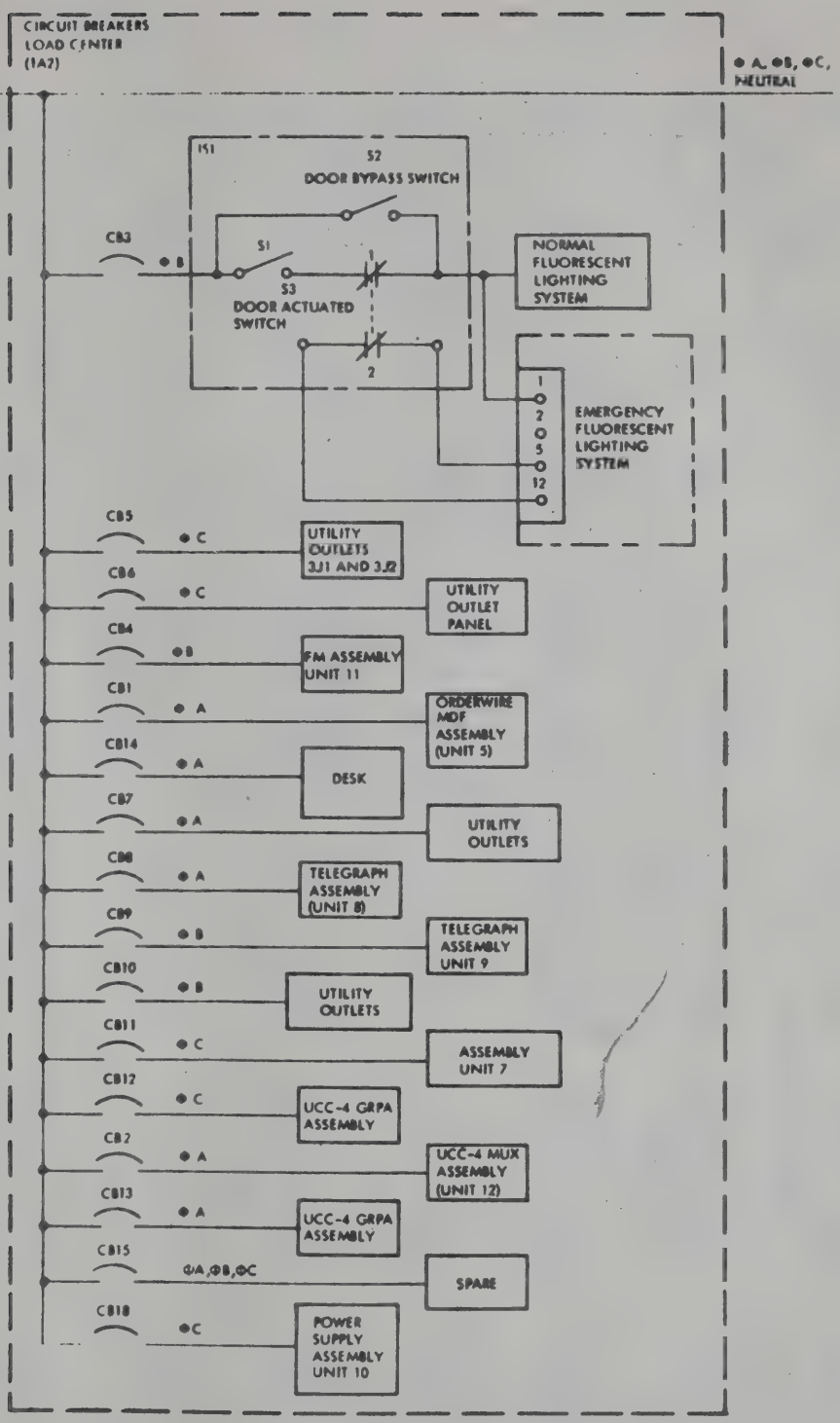
AN/TCC-79 ROADSIDE RACK ELEVATIONS


FM (PSK)
UNIT 11
LINE XFRMR A1
BLANK PANEL A2
IF/BB PATCH ASSY A3
A4
FM MOD OM-46(V) 2/TCC A5
DEMOD OM-47(V) 2/TCC A6
A7
BLANK PANEL A8
A9
BLANK PANEL
UCC-4
UNIT 12
IND-PWR SUPPLY ID-1077/MRC-98 A1
A2
TEL TEST SET GRP OQ-19/UCM-1
COMM PATCH PNL SB-3080/UCM-1
BLANK PANEL A4
DEMULTIPLEXER GRP OA-7370 (V) 12/UCC-4(V) A5
MULTIPLEXER GRP OA-7371 (V) 12/UCC-4 (V) A6
ENV DLY EQ GRP OA-8371 (V) 12/UCC-4 (V) A7
TEL CARRIER FREQ SUPPLY GRP OA-7377/FCC-17 A8
PLT FREQ INJECTOR GRP CH-602/UCC-4 (V) A9
AMP CONT GRP OG-51 (V) 2/UCC-4 (V) A10
A11
INTERCONNECTING GRP OA-7181/FCC-17
A12
INTERCONNECTING GRP ON-99/UCC-4 (V) A13
A14
UCC-4 GRP A
UNIT 13
48 V FLTR & FUSE PNL A1
ELECTRONIC VM ME-451/G A2
SUPERGROUP SEP PNL A3
BLANK PANEL A4
GRP A MOD/DEMOD A5
GRP A COMBINER A6
TEL CARRIER FREQ SUPP GRP TA-495/MRC-98 A7
TEL PLT FREQ SUPP GRP OV-3/UCC-4 (V) A8
PLT DISTR GRP OA-8374 (V) 1/UCC-4 (V)
TEL CARRIER FREQ SUPP GRP OA-4110/GCC A10
TEL CARRIER FREQ SUPP GRP OA-4113/GCC A11
GRP A FREQ SUPP A12
GRP A SYNC PLT CONV A13
TEL MODE SPT MT-2478 GCC EQUIPPED W/SIG DATA XLTR A14
BLANK PANEL A15

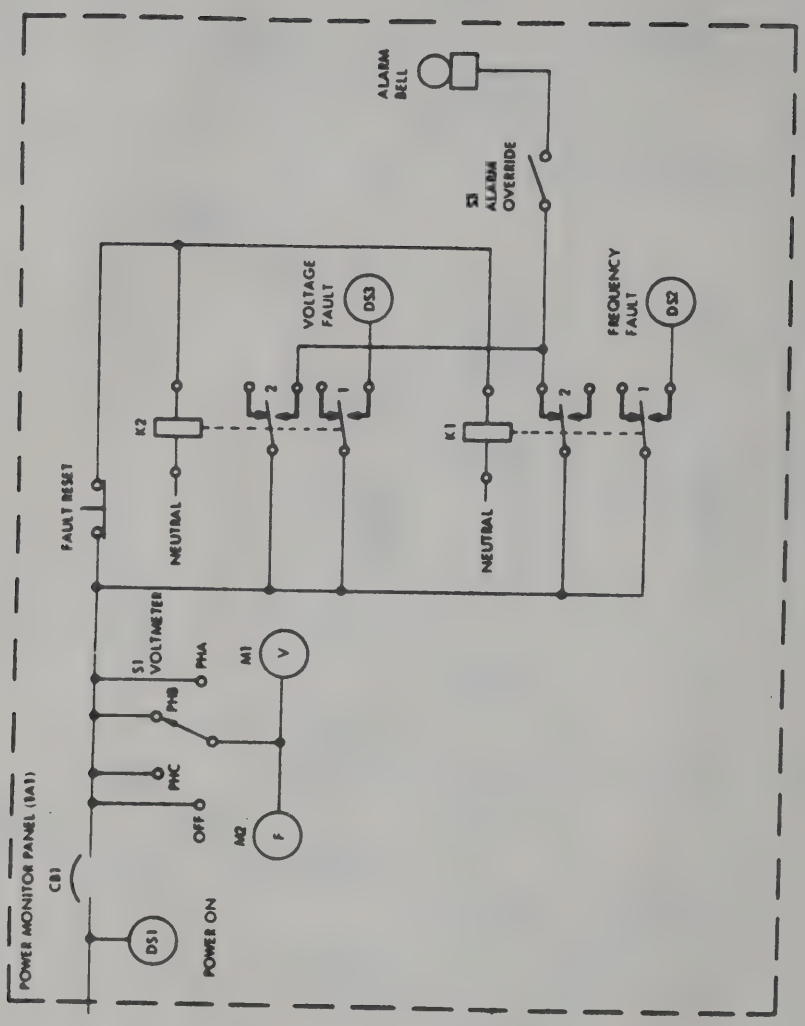
AN/TCC-79 CURBSIDE RACK ELEVATIONS



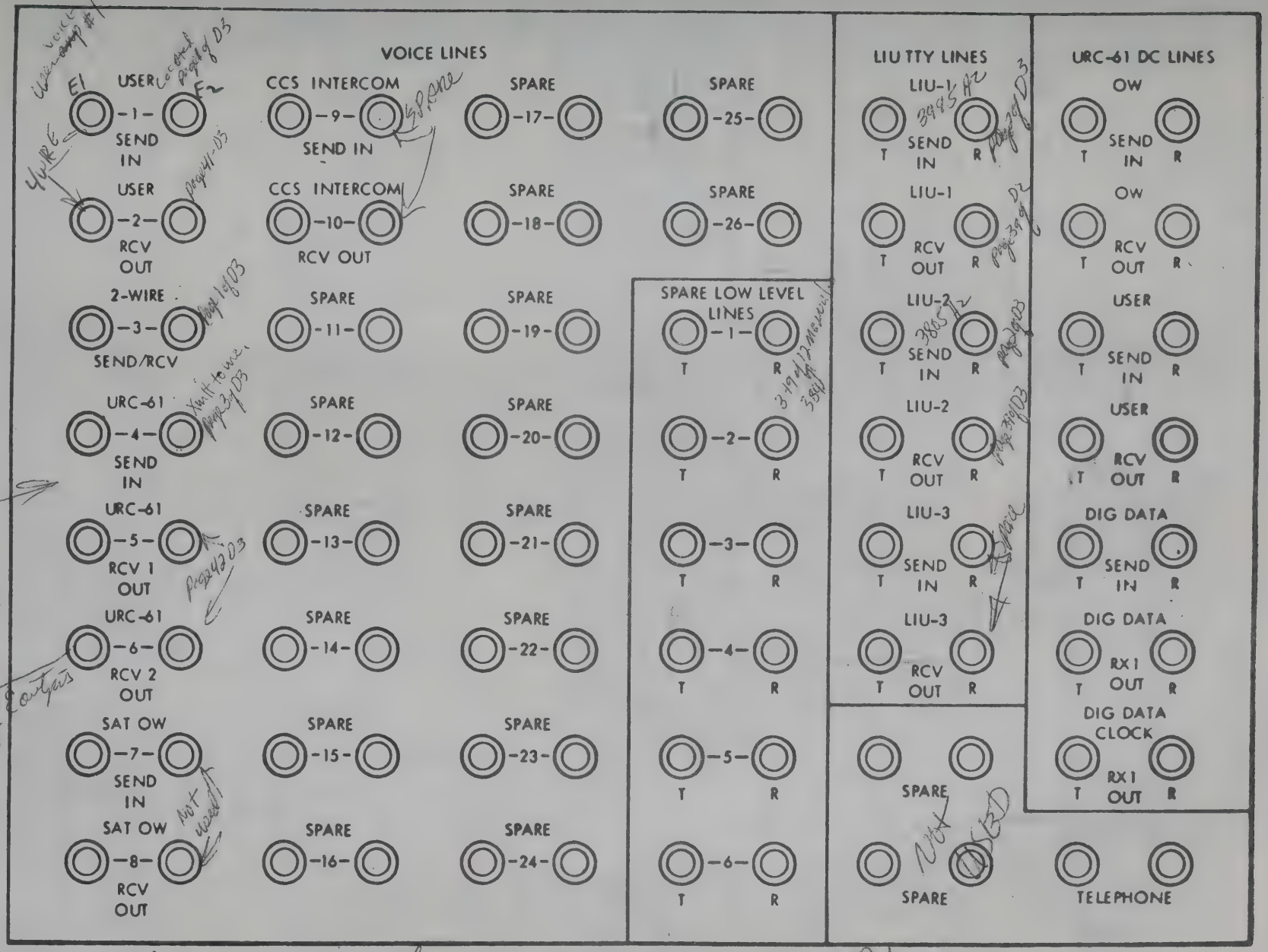
POWER ENTRANCE PANEL 1A4



LOAD CENTER 1A2

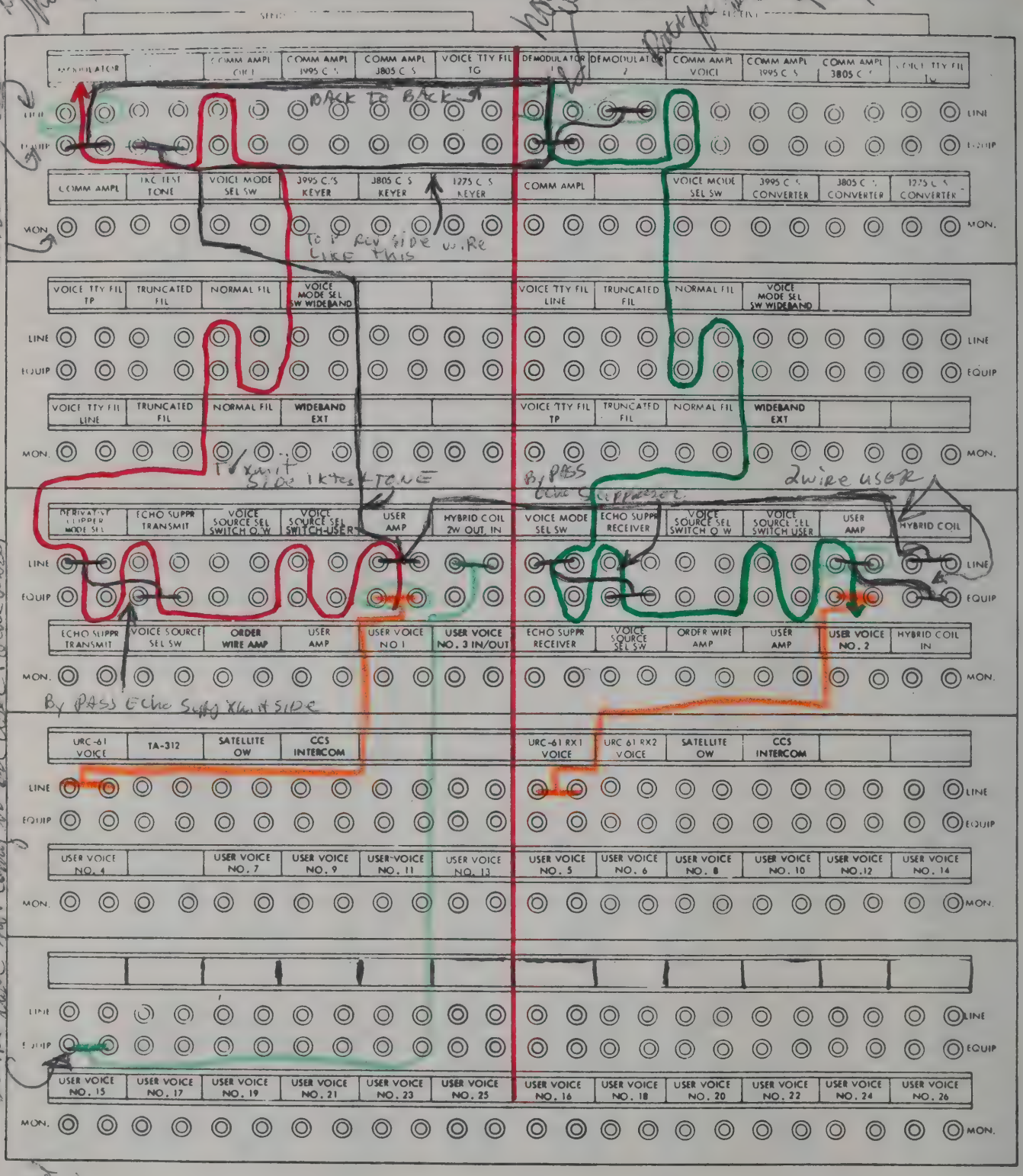


POWER MONITOR PANEL 1A1

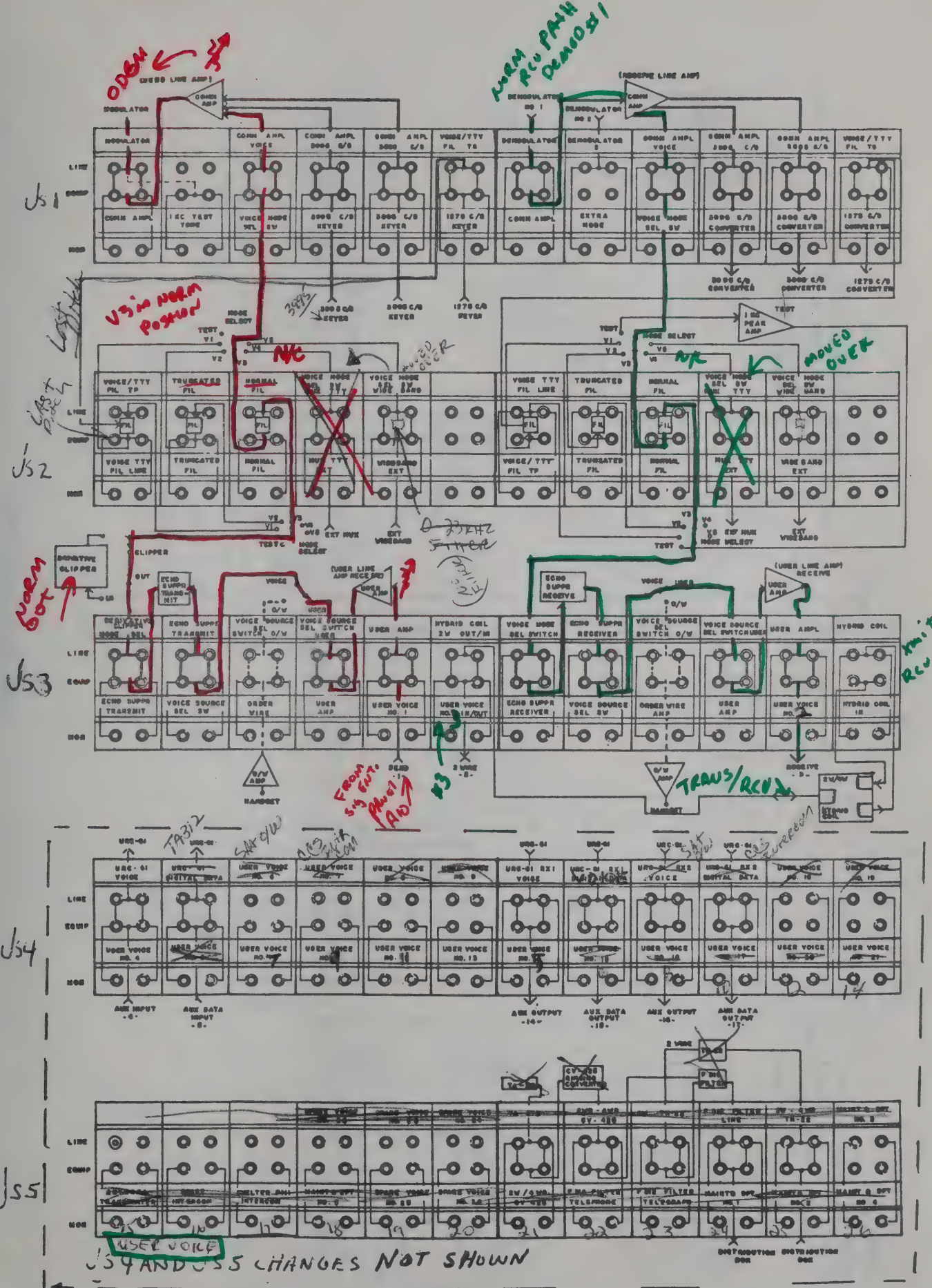


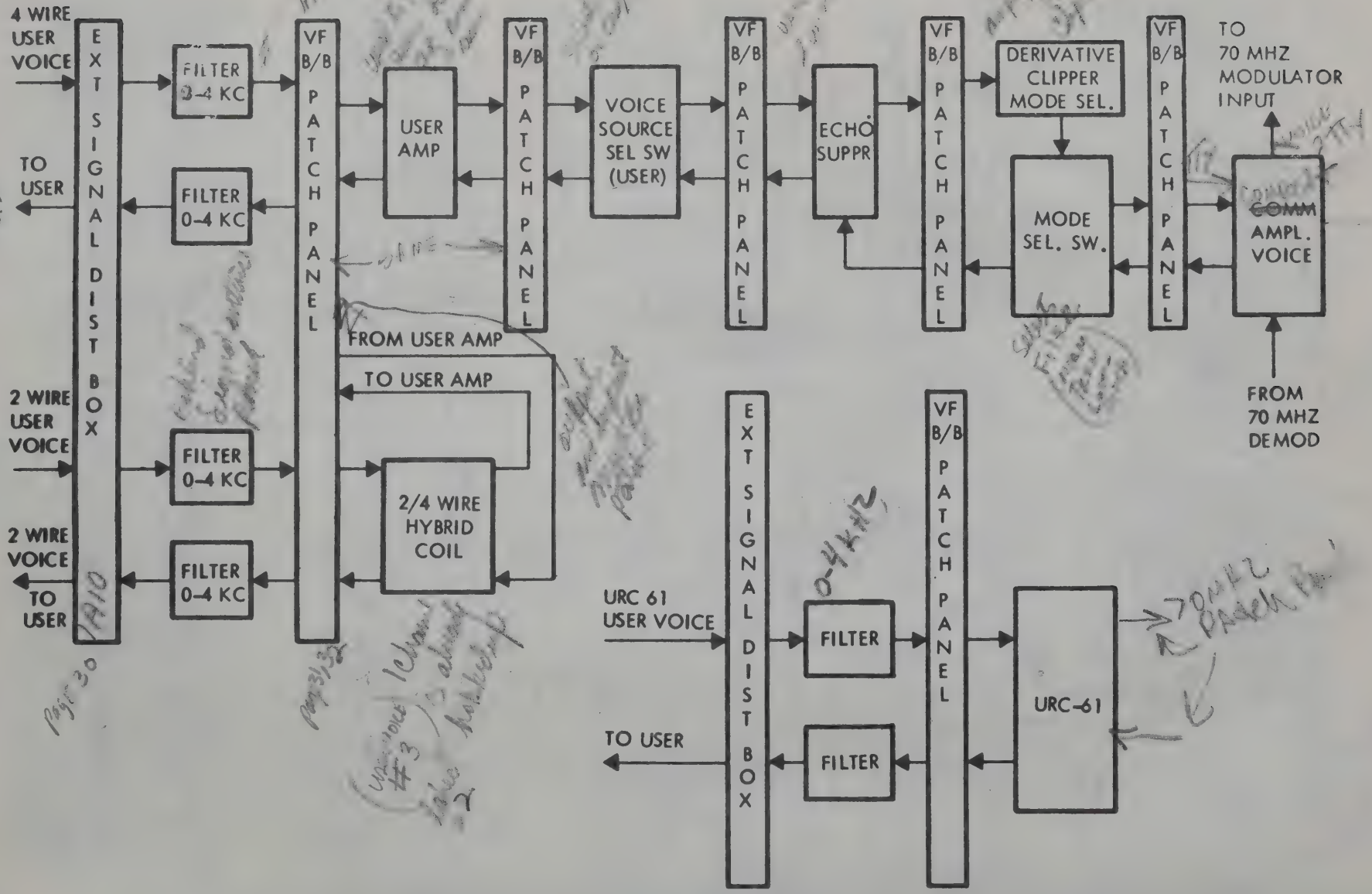
EXTERNAL DISTRIBUTION BOX

Shelter Signal entire panel
When moved you have a cover.

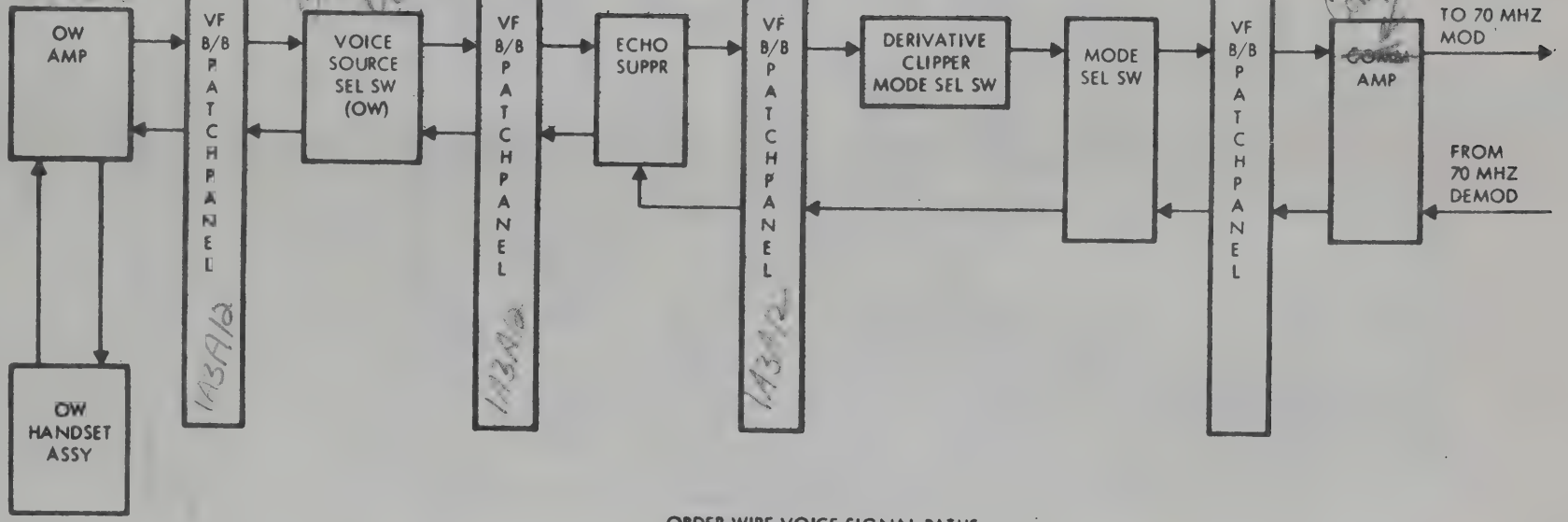


JS1 → LINE J1–J24
JS5 EQUIP J25–J48
MON J49–J72

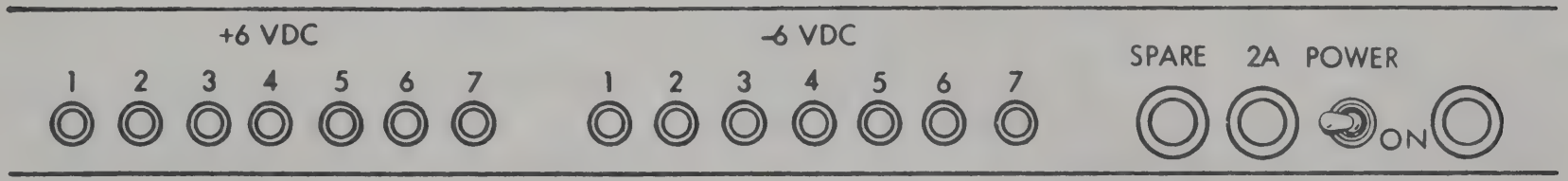

JS1
JS2
JS3
JS4
JS5
ODEM
NORM RCV PATH DEMOD
V3 in NORM POSITION
MOVED OVER
NORM OUT
TRANS/RCV
FROM SIG OUT
USER VOICE
JS4 AND JS5 CHANGES NOT SHOWN

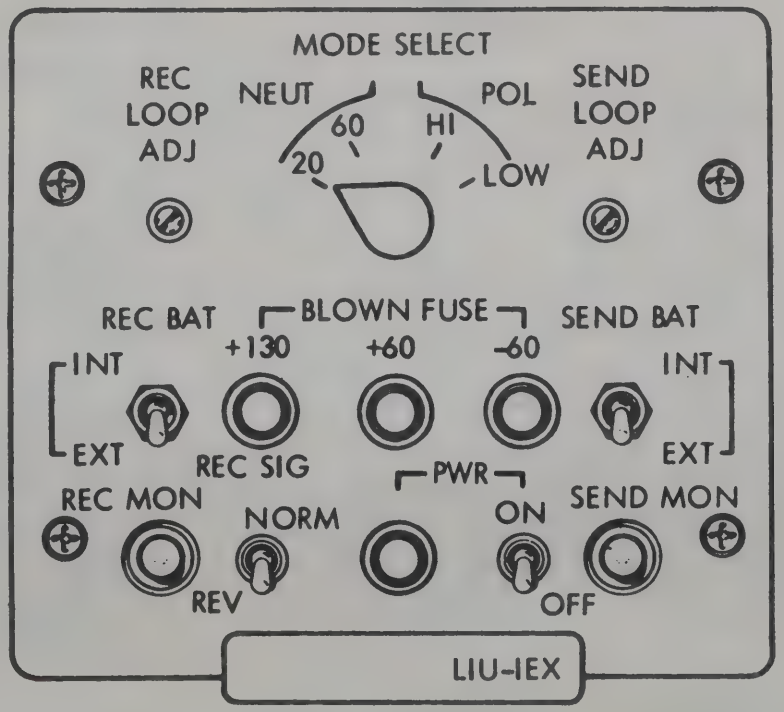


USER VOICE SIGNAL PATH

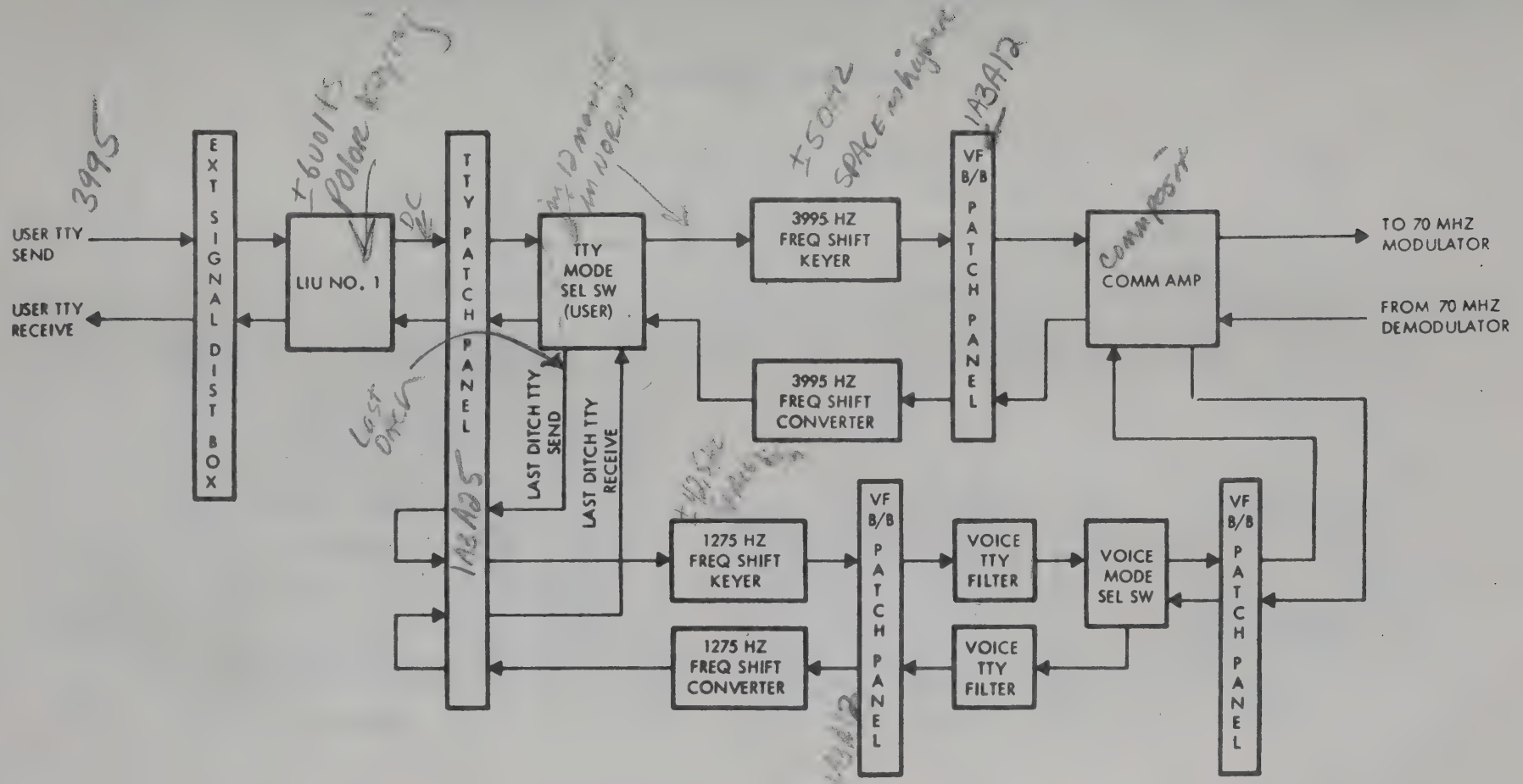


ORDER WIRE VOICE SIGNAL PATHS



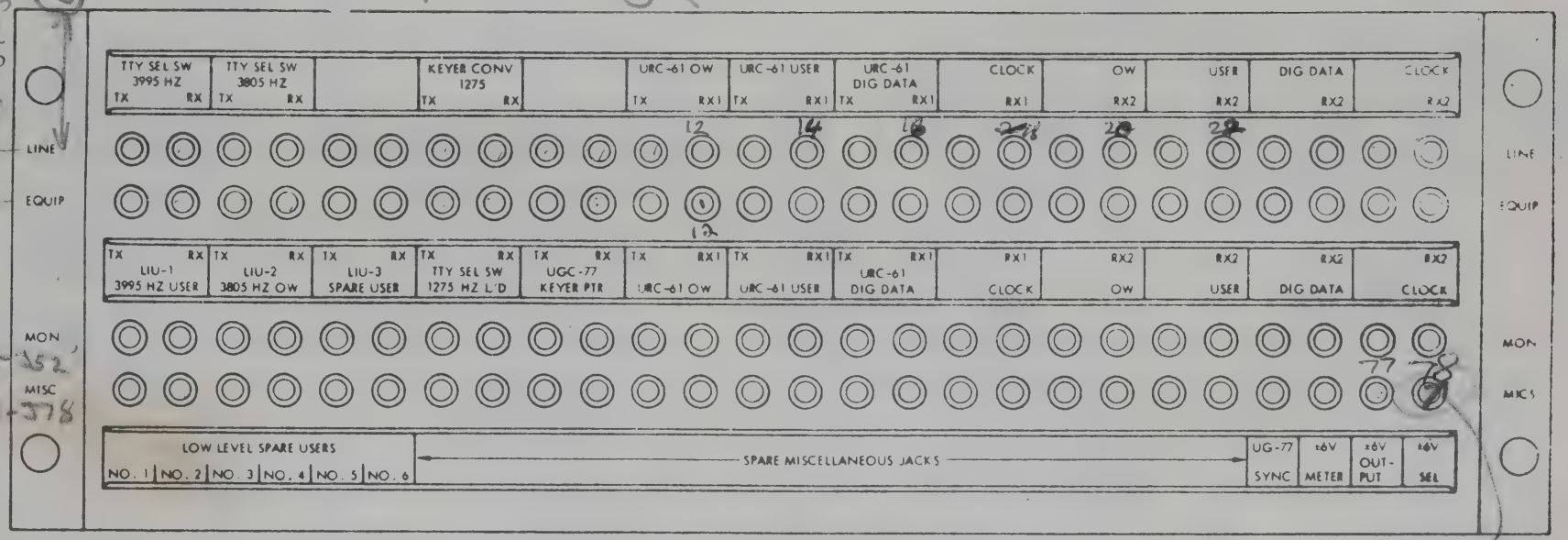


LINE ISOLATION UNIT

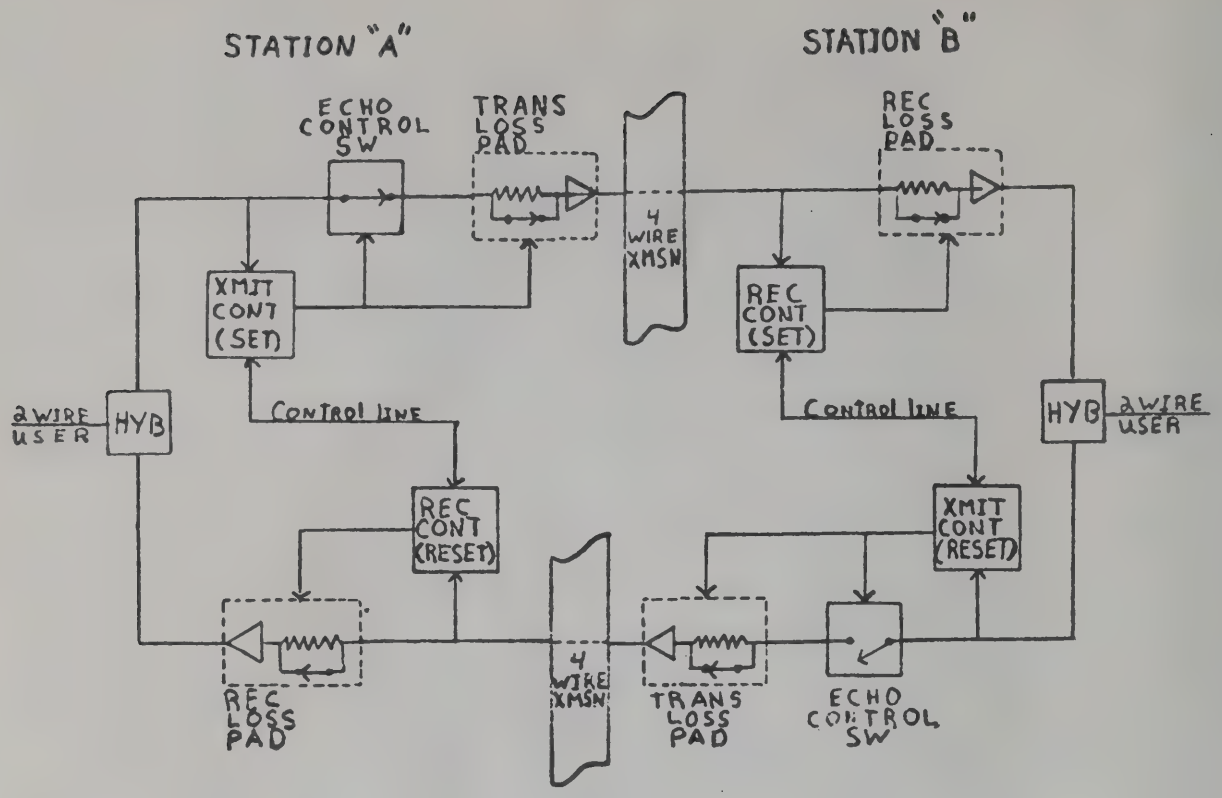


TTY SIGNAL PATHS

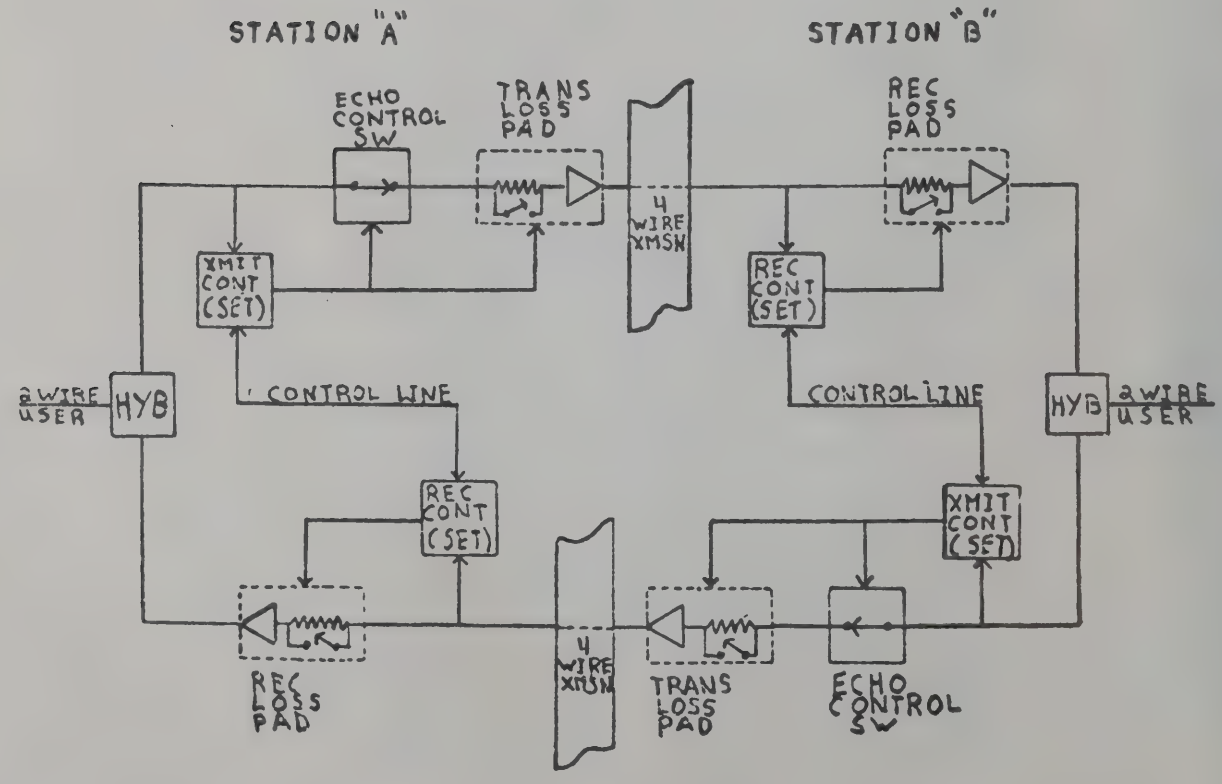
ORDER WIRE TTY SIGNAL PATHS



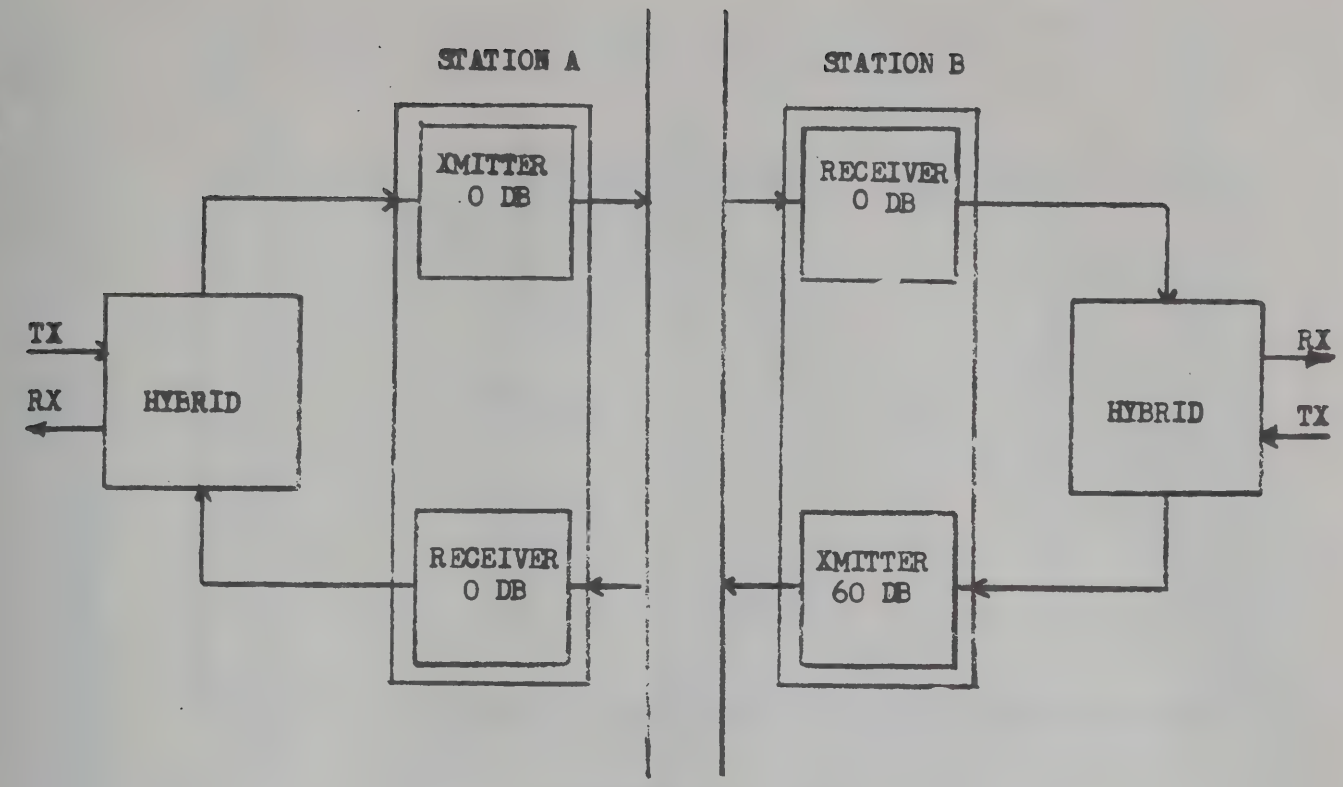
D.L. TTY PATCH PANEL



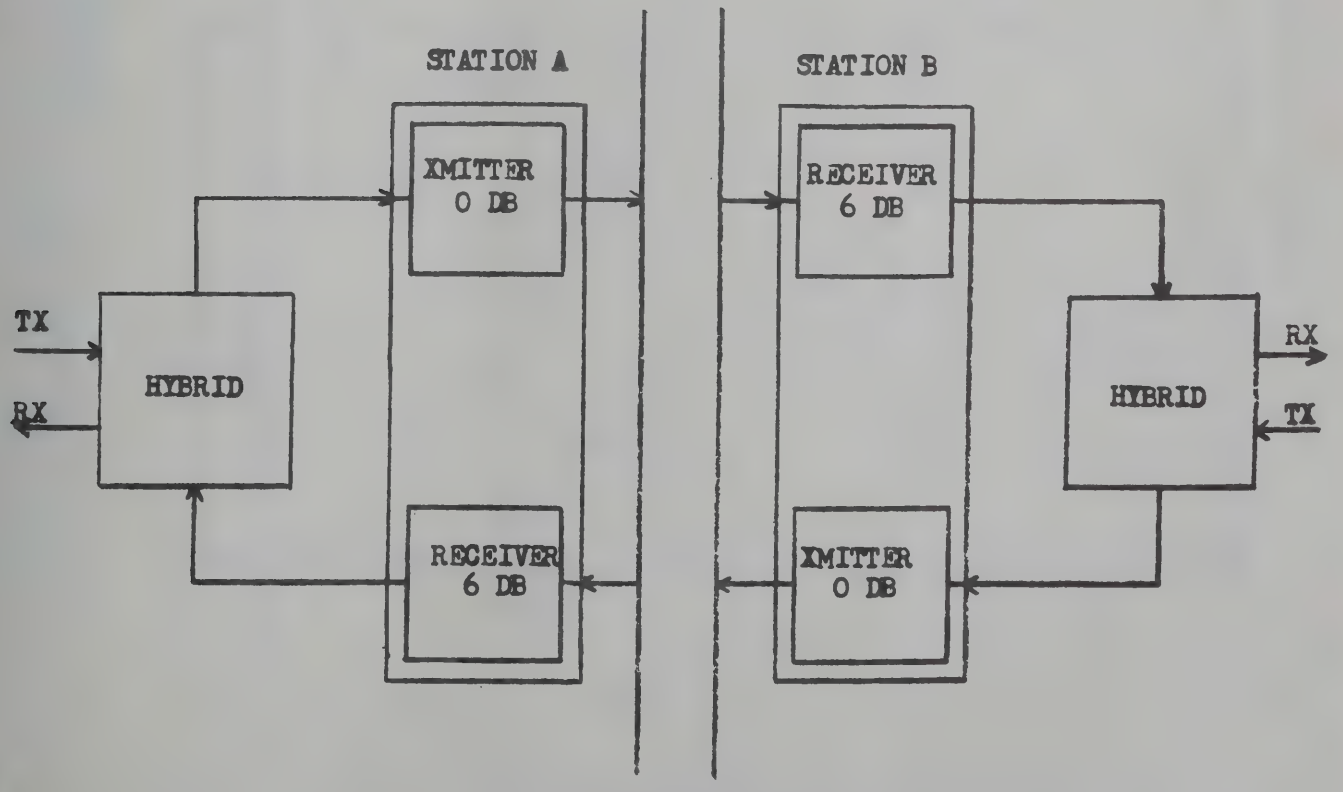
Mode 1 Operation (Uni-Directional)



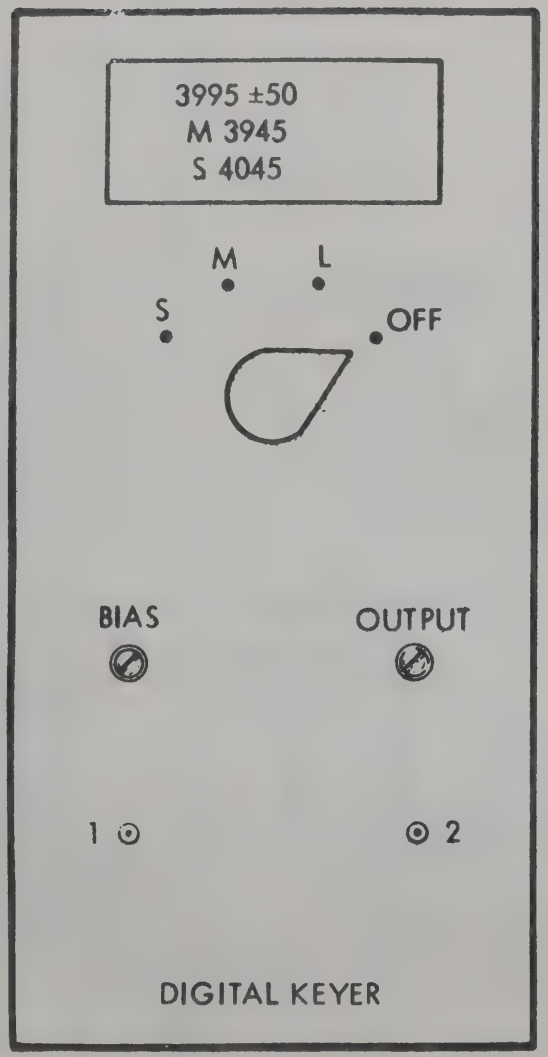
Mode 2 Operation (Bi-Directional)



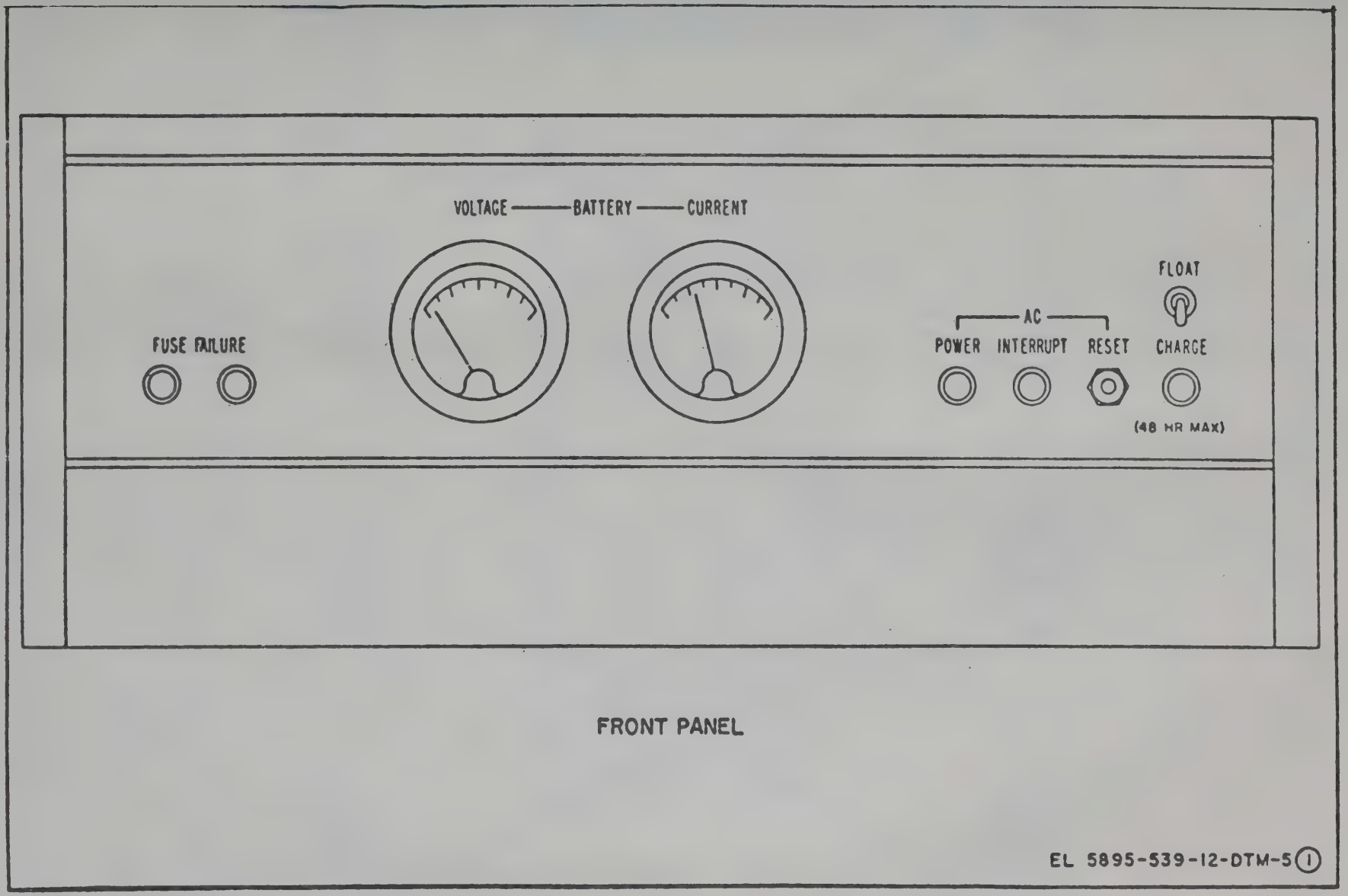
UNIDIRECTIONAL MODE
(SEND AND RECEIVE)



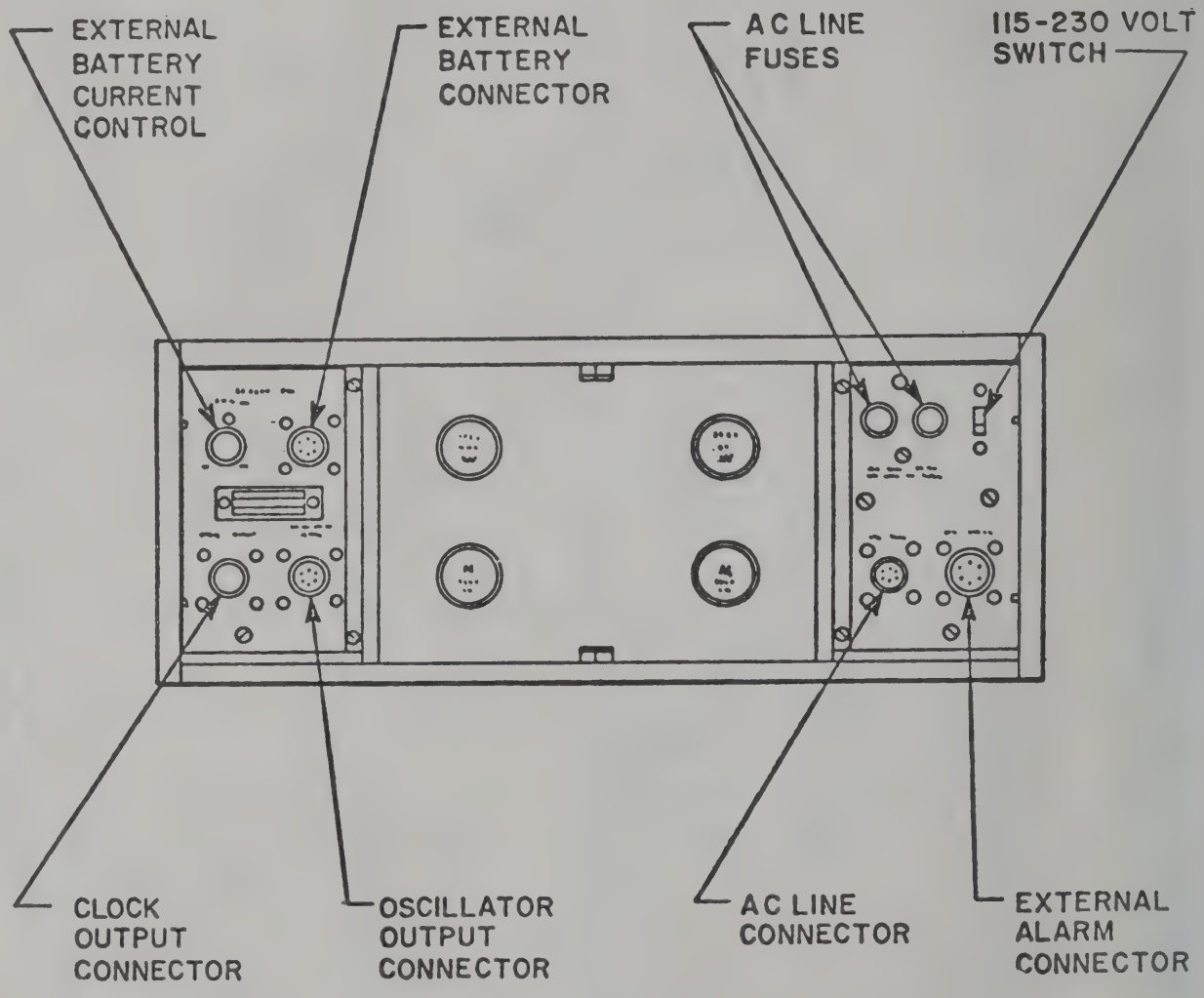
BIDIRECTION MODE
(SEND AND RECEIVE)



FREQUENCY SHIFT KEYER CONVERTER



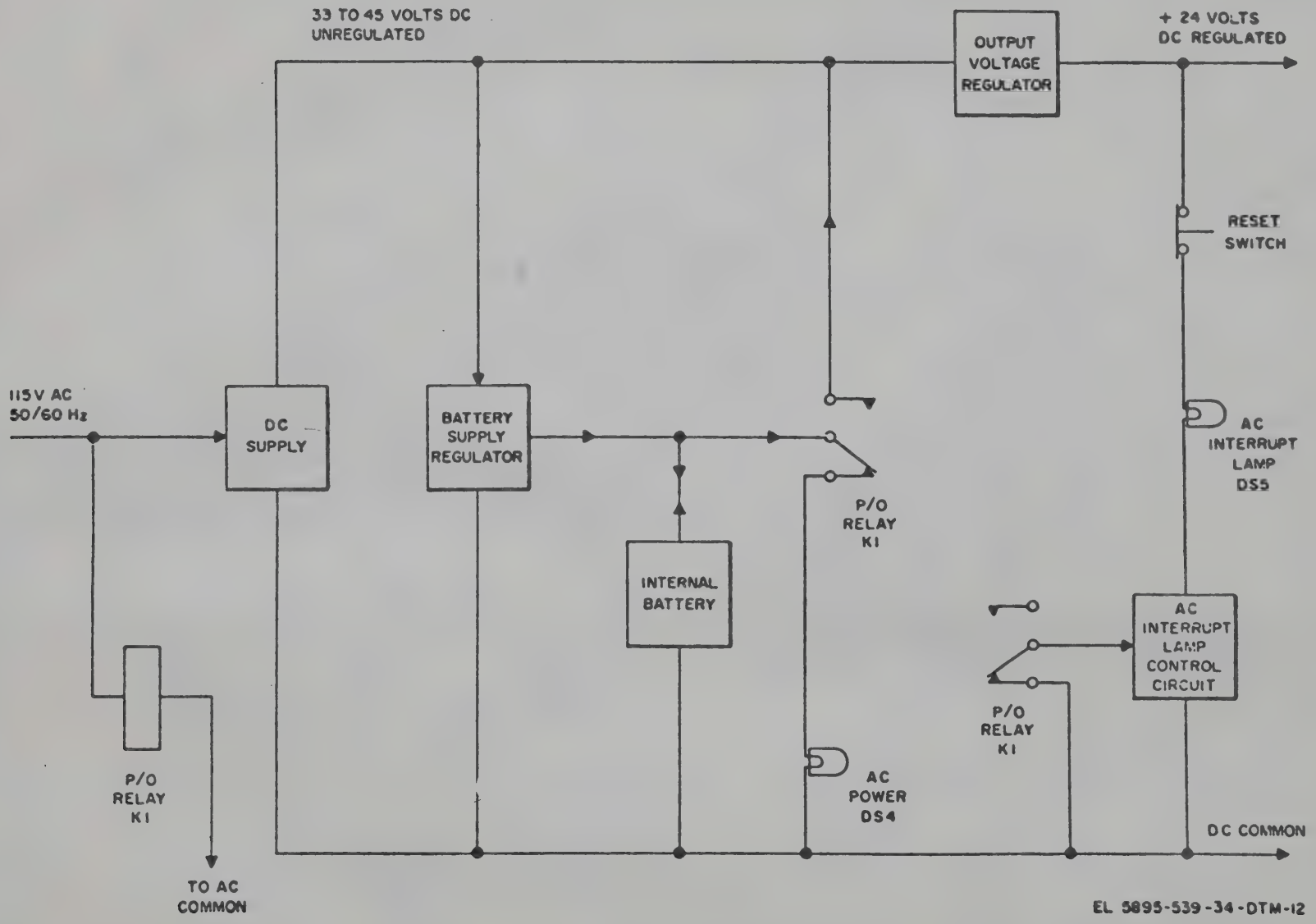
(1) Standby power supply, controls and indicators



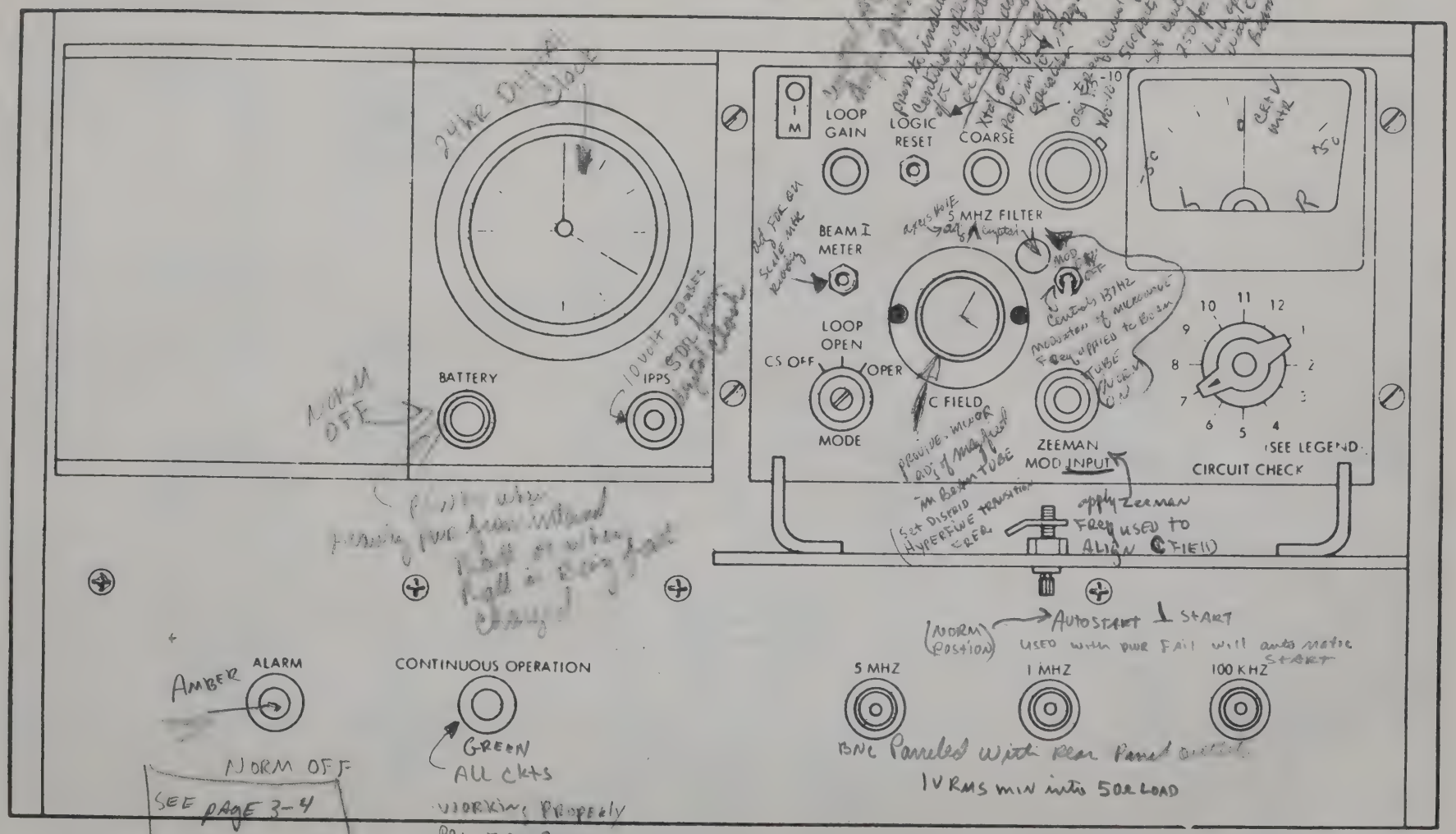
REAR PANEL

EL 5895-539-12-DTM-5 ②

② Standby power supply, controls and indicators



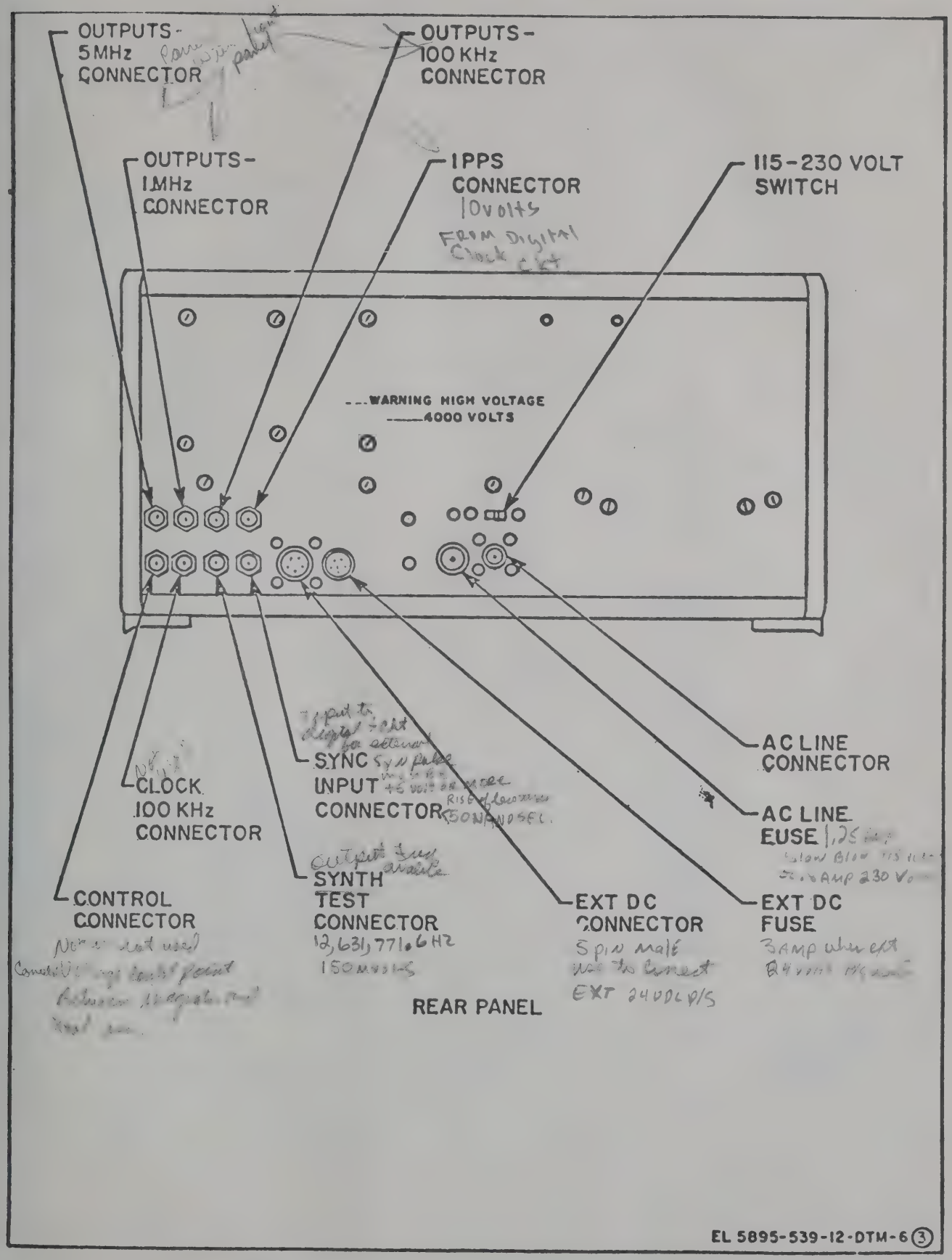
Standby power supply block diagram



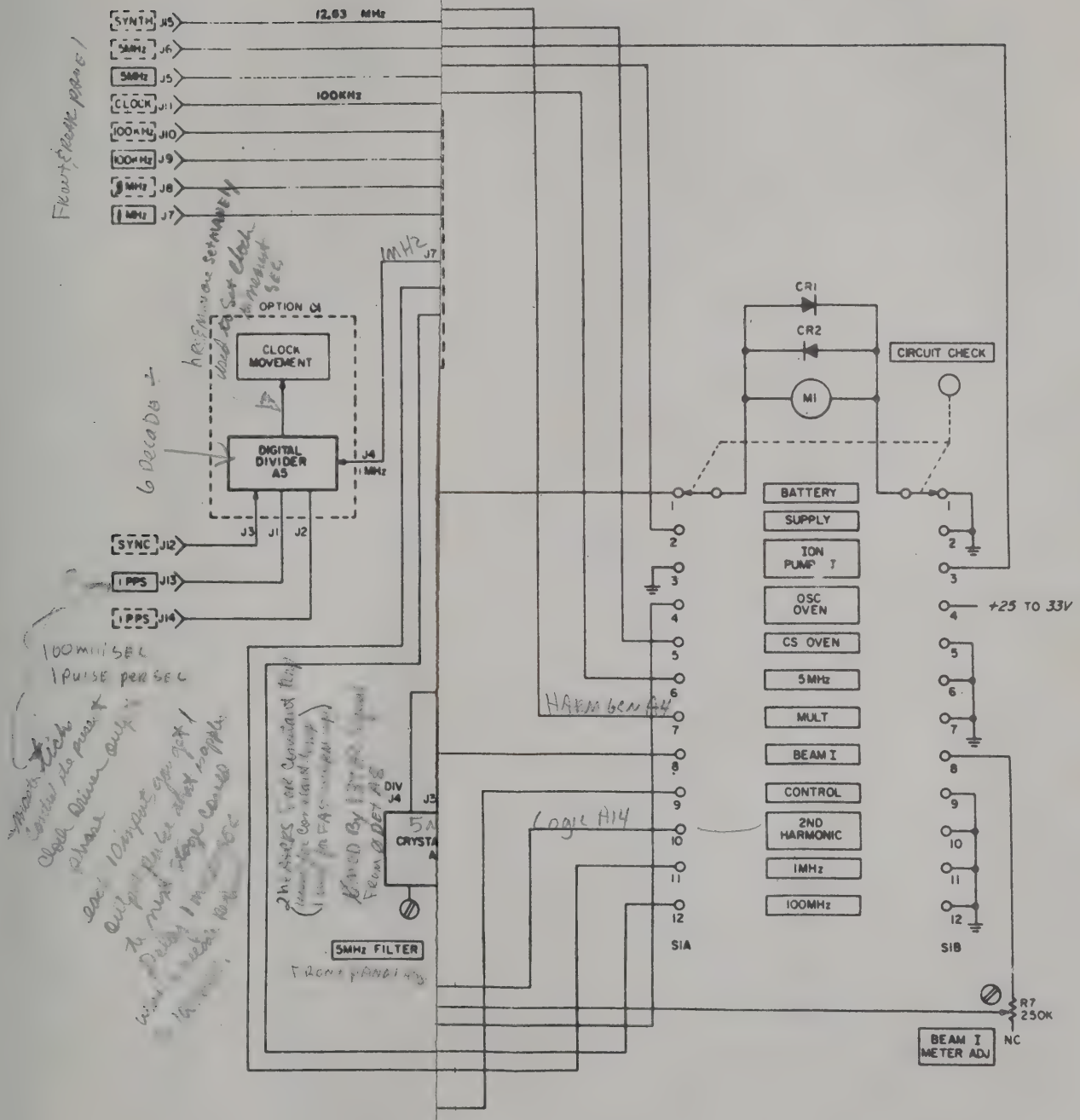
LEGEND

1. CONTROL
2. 2ND HARMONIC
3. 1 MHz
4. 100 KHz
5. BATTERY
6. SUPPLY
7. ION PUMP I
8. OSC OVEN
9. CS OVEN
10. 5 MHz
11. MULT
12. BEAM I

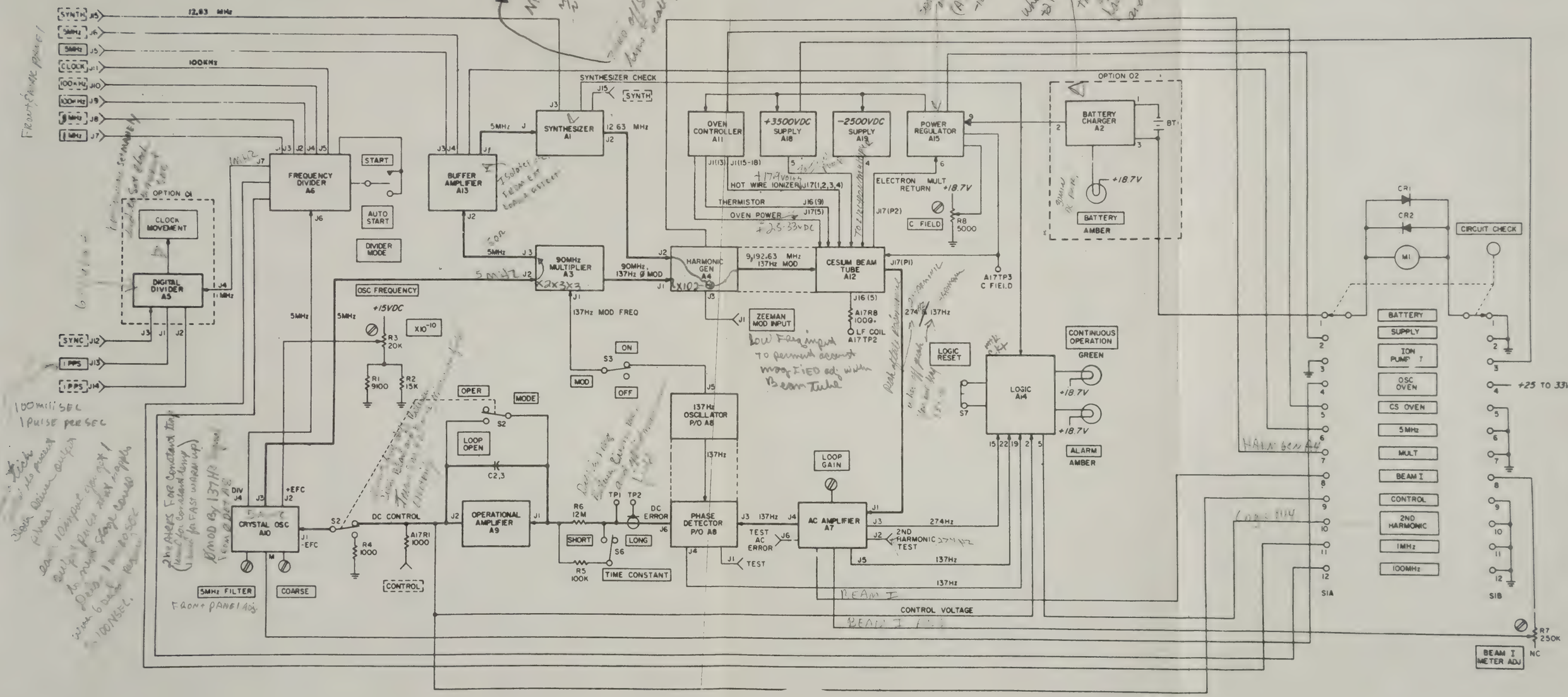
OPERATOR'S CONTROLS, CESIUM BEAM FREQUENCY STANDARD



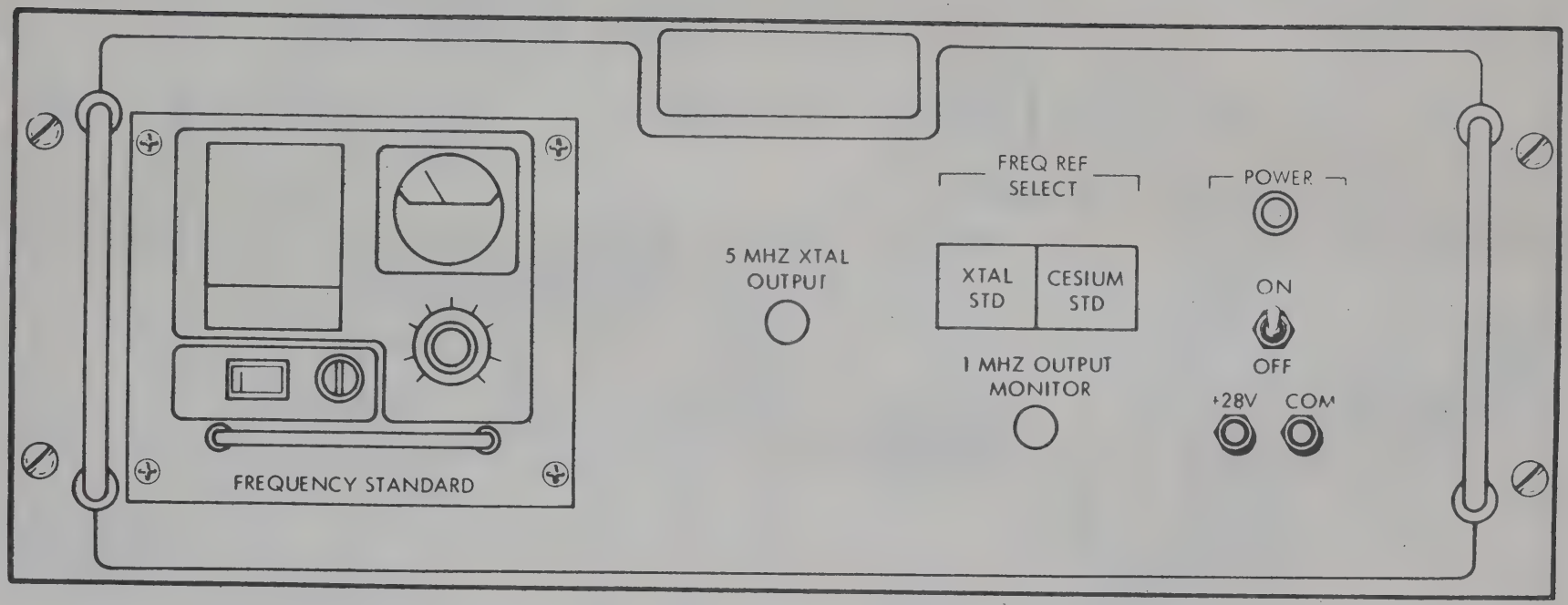
③ Cesium beam frequency standard, controls and indicators



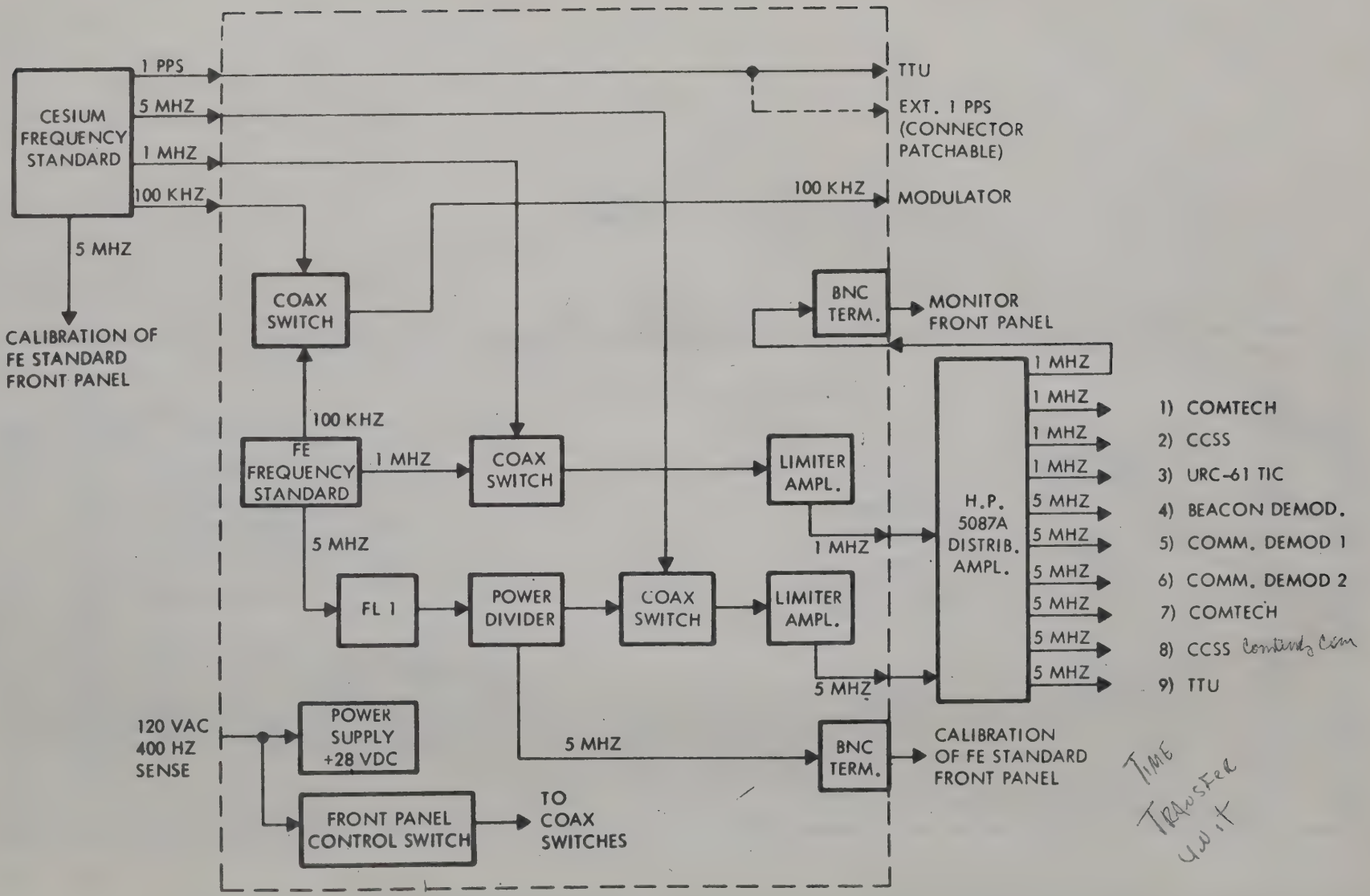
n Standard Block Diagram



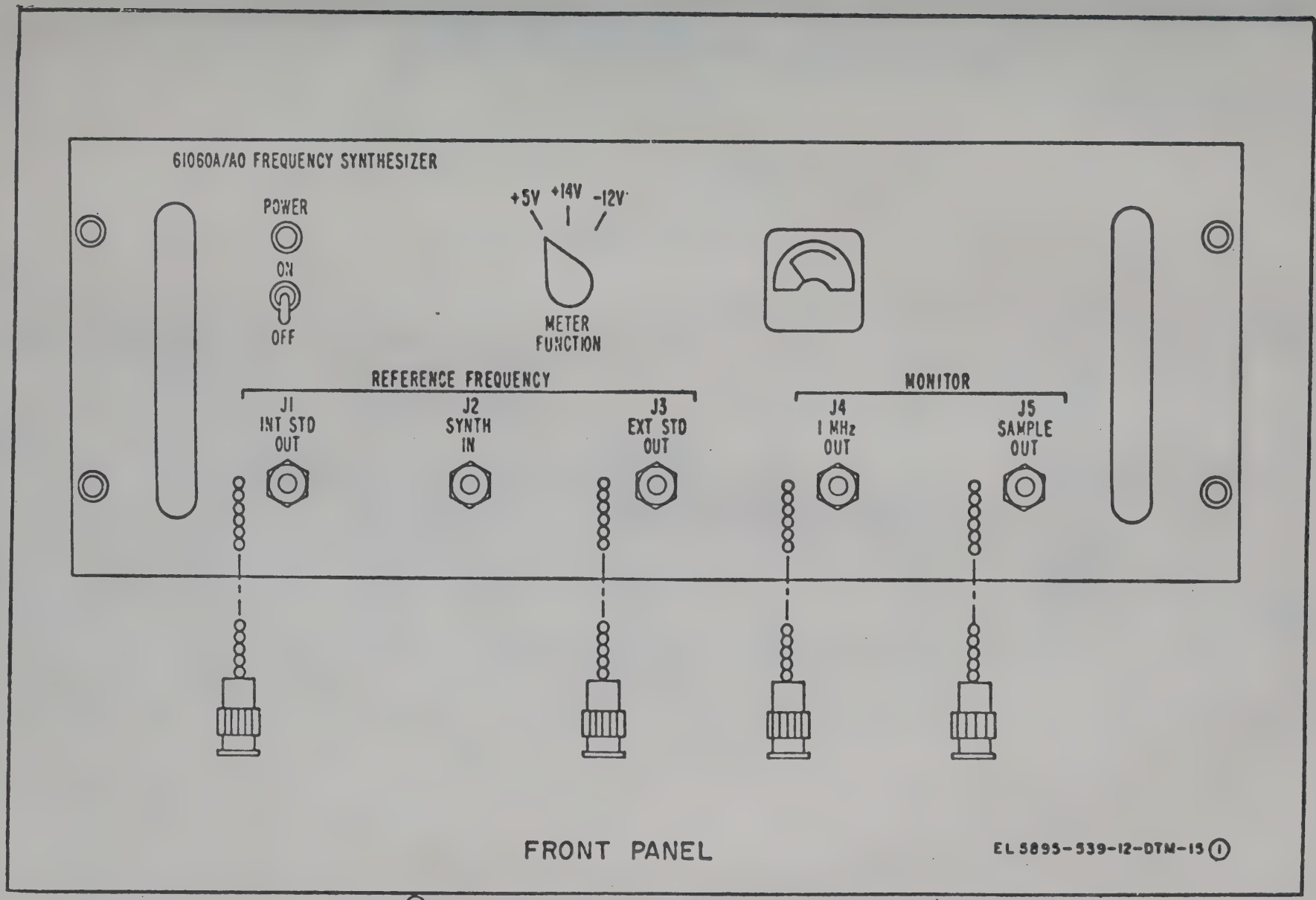
Cesium Standard Block Diagram



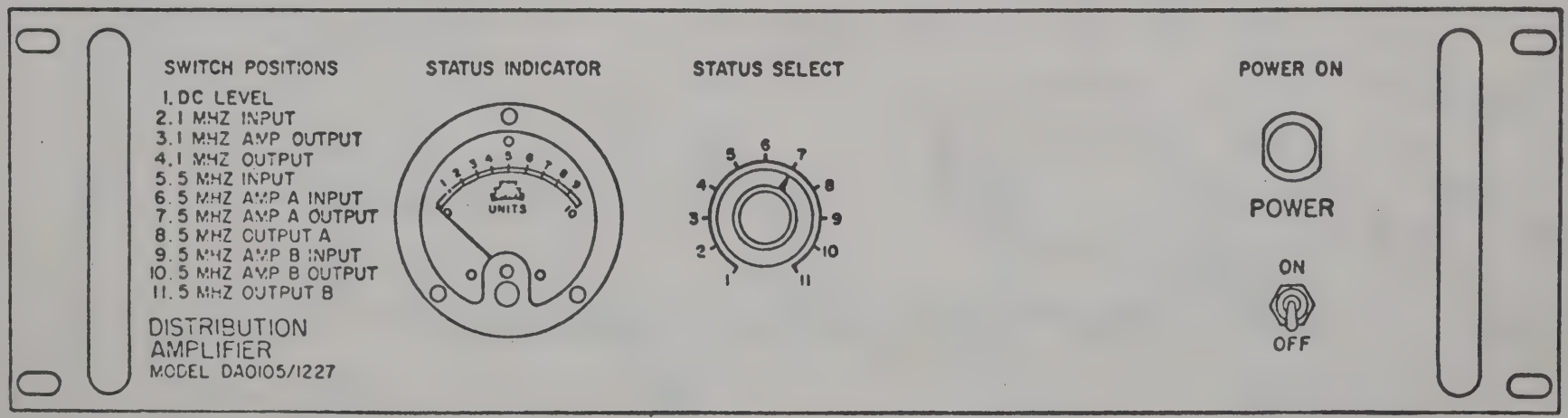
FREQUENCY DISTRIBUTION UNIT



FREQUENCY GENERATION AND DISTRIBUTION

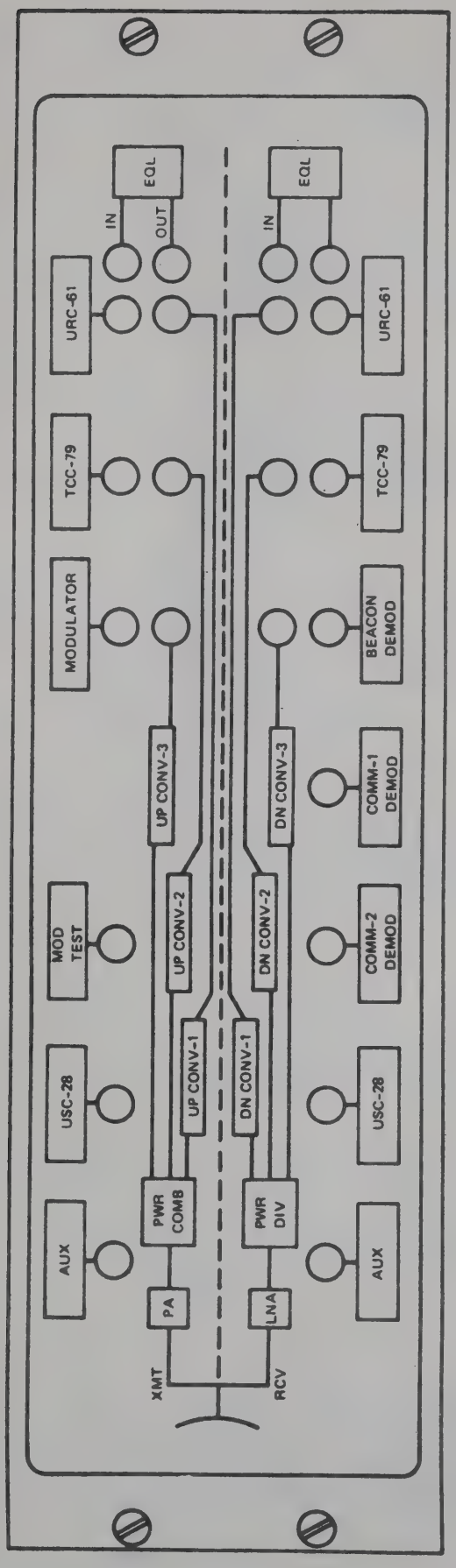


(1)Electronic Frequency Synthesizer 0-1658/MSC-46(V), controls and indicators

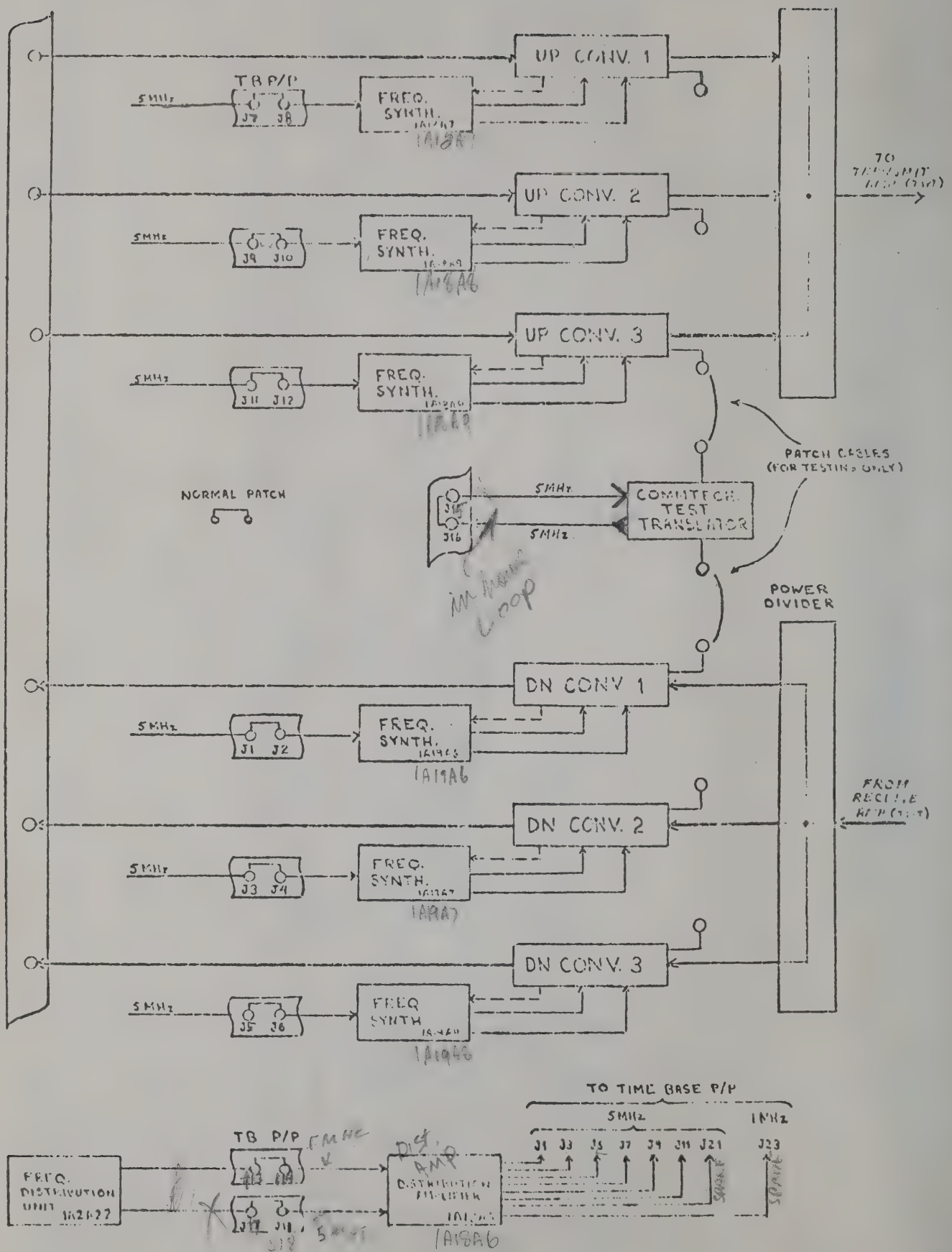


FRONT PANEL

① Radio Frequency Amplifier AM-6631/MSC-46(V), controls and indicators



IF PATCH PANEL



FREQUENCY CONVERSION SUBSYSTEM

INPUT:

Frequency	70 MHz
Bandwidth	40 MHz at ±1.0 dB
Level	-10 dBm to +10 dBm
VSWR	1.15:1 maximum

OUTPUT:

Frequency Band	7.9 to 8.4 GHz
Bandwidth	500 MHz at ±0.5 dB
Level	-1.5 to -31.5 dBm continuously adjustable

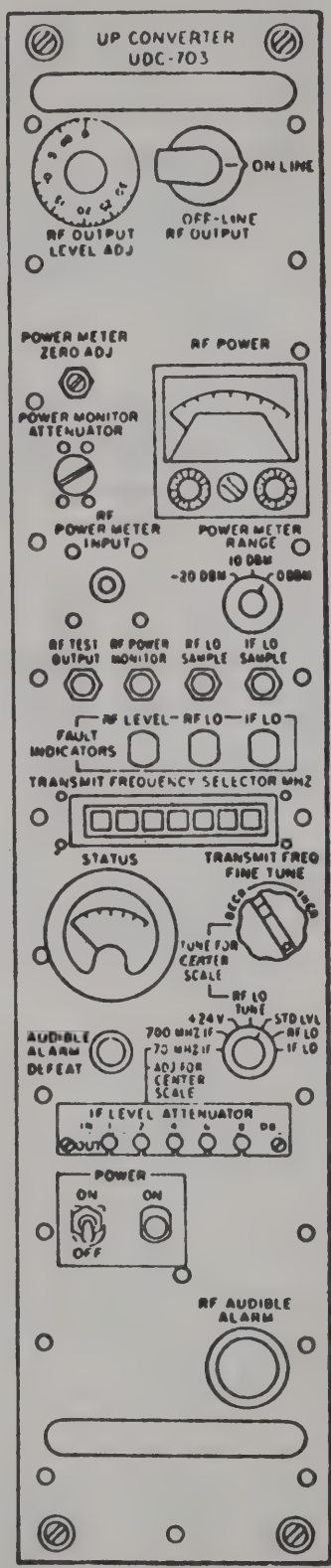
VSWR: 1.5:1 maximum over the band

AMPLITUDE RESPONSE: ±0.5 dB at ±5 MHz of output frequency ±1.0 dB at ±20 MHz of output frequency

GAIN STABILITY:

Long Term	Less than 1.0 dB in any 24 hour period
Short Term	Less than 0.1 dB per minute

ELECTRICAL CHARACTERISTICS: UP CONVERTER



Electronic Frequency Up-Converter CV-3084/MSC-46(V), controls and indicators.

102-F6/A01-A68-D(2)

INPUT:

Frequency	7.25 to 7.75 GHz
Bandwidth	500 MHz at 0.5 dB
Level	-43 to -103 dBm
Impedence	50 ohms

OUTPUT:

Frequency	70 MHz
Bandwidth	40 MHz at 0.5 dBm
Level	0 ±0.5 dB for RF input of -30 dBm
Impedence	50 ohms

NOISE FIGURE: 16.5 dB max

GAIN: 43 ±0.5 dB

GAIN STABILITY:

Long Term	Less than 1.0 dB in any 24 hour period
Short Term	Less than 0.1 dB per minute

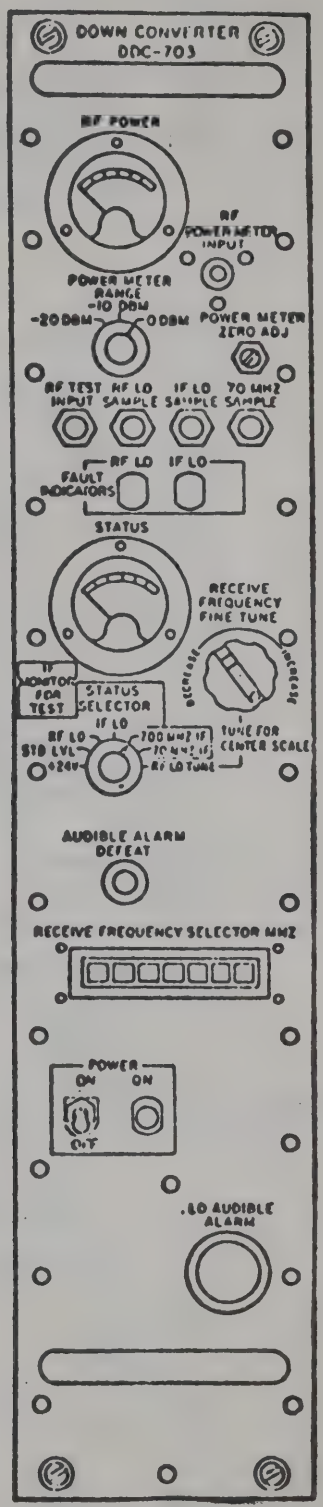
FREQUENCY STABILITY (slaved to station standard):

Long Term	$\pm 1 \times 10^{-11}$ for life of atomic frequency standard
Short Term	$\pm 1 \times 1^{-11}$ with 0.1 second averaging time

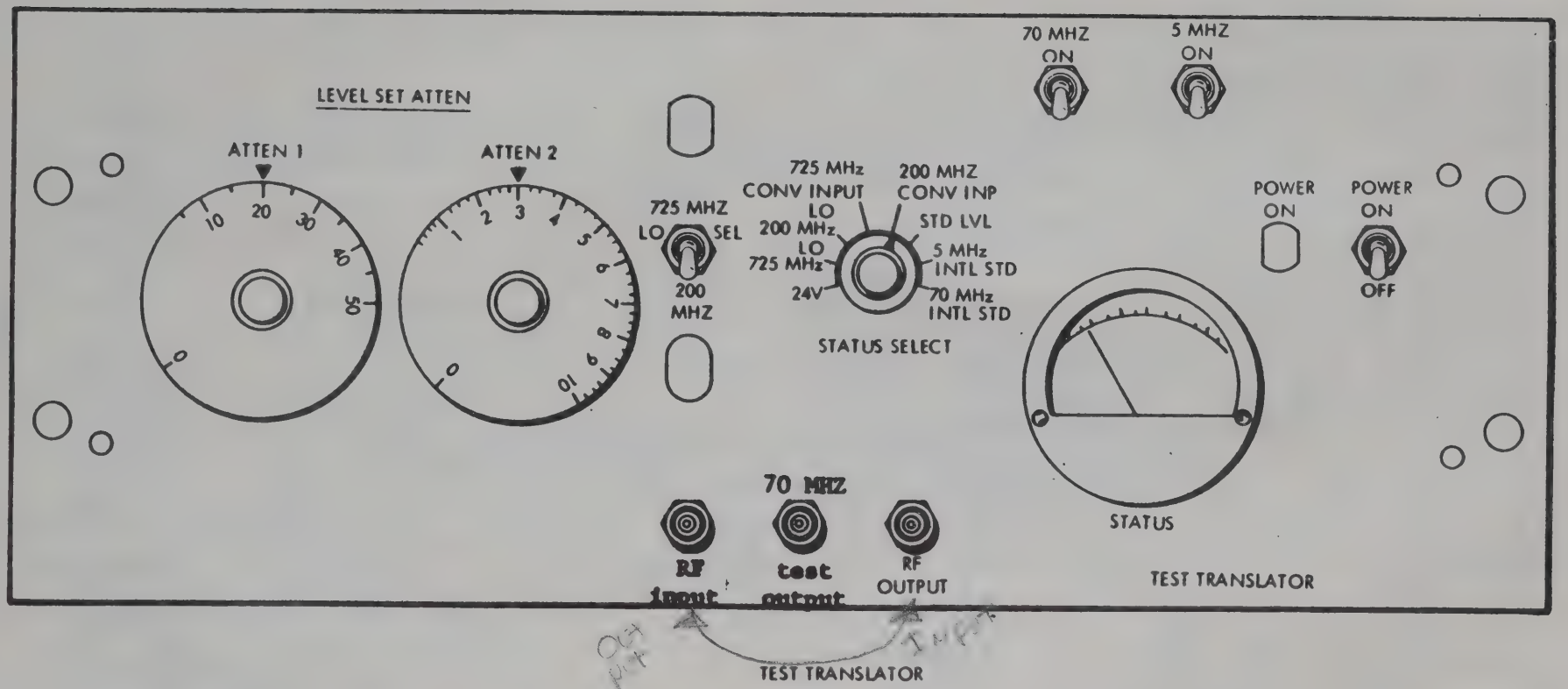
FREQUENCY STABILITY (slaved to associated frequency synthesizer standard):

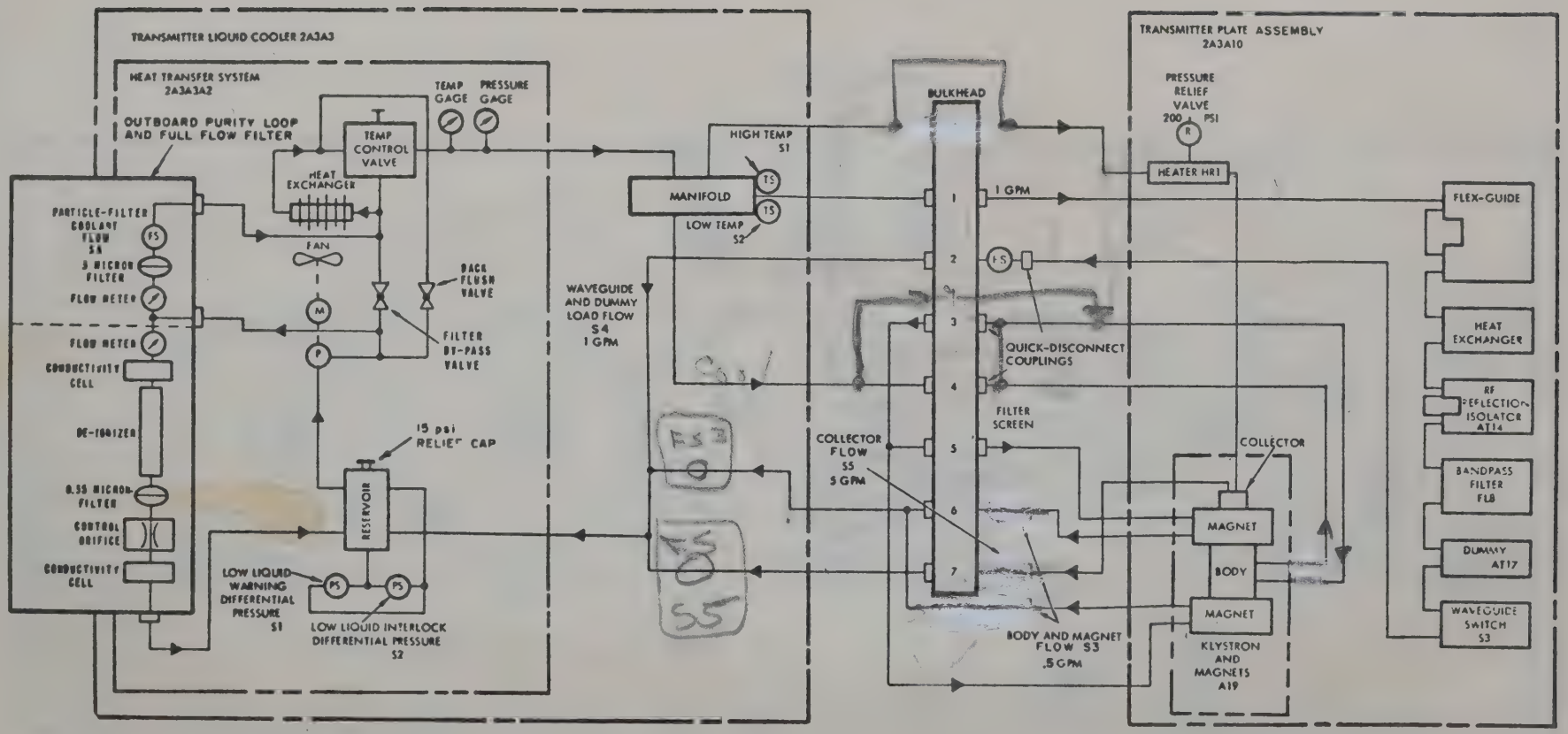
Long Term	1 part in 10^9 per 24 hours
Short Term	1 part in 10^{10} with 0.1 second averaging time

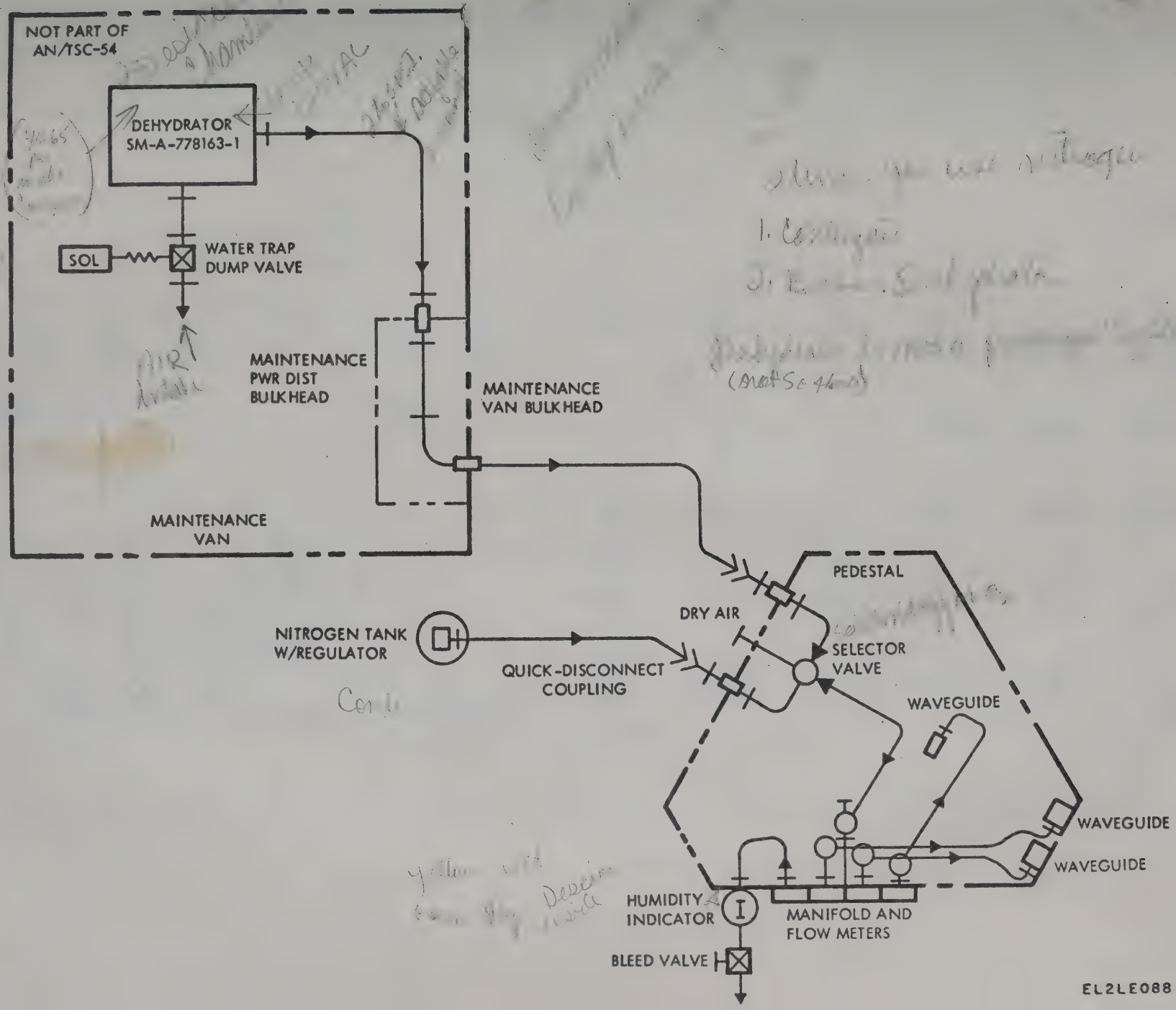
ELECTRICAL CHARACTERISTICS: DOWN CONVERTER

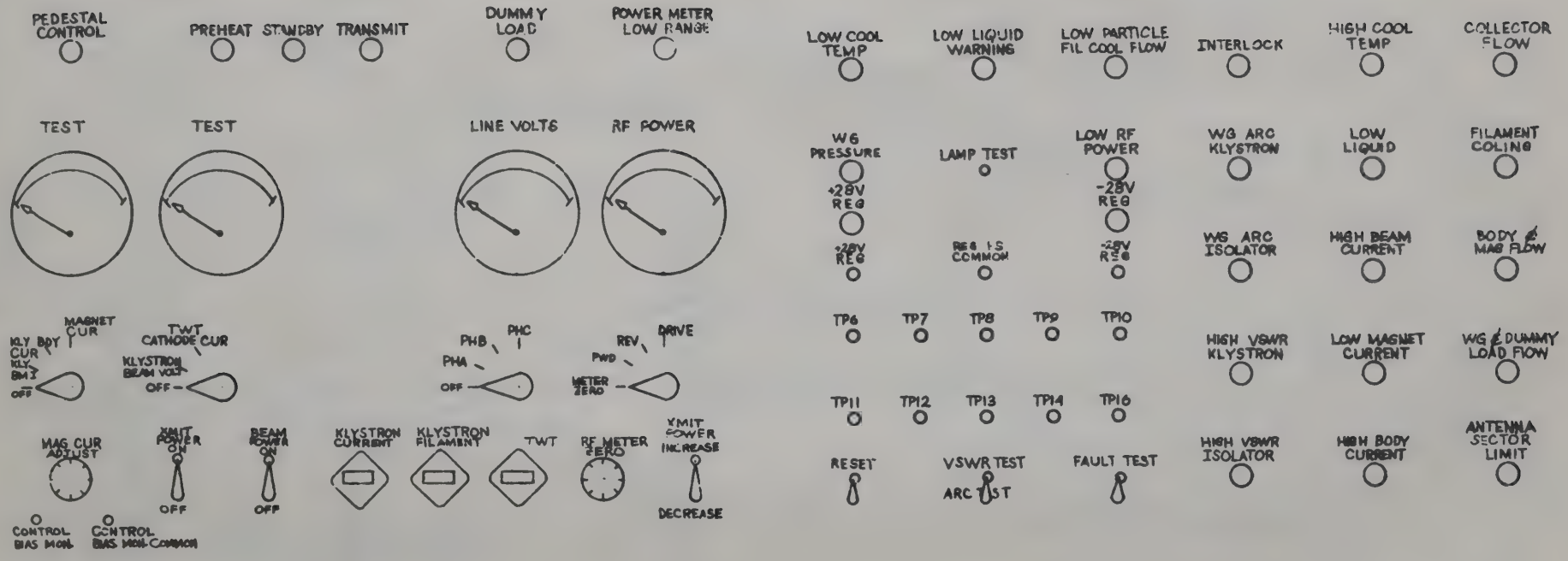


Electronic Frequency Down-Converter CV-3085/MSC-46(V), controls and indicators.

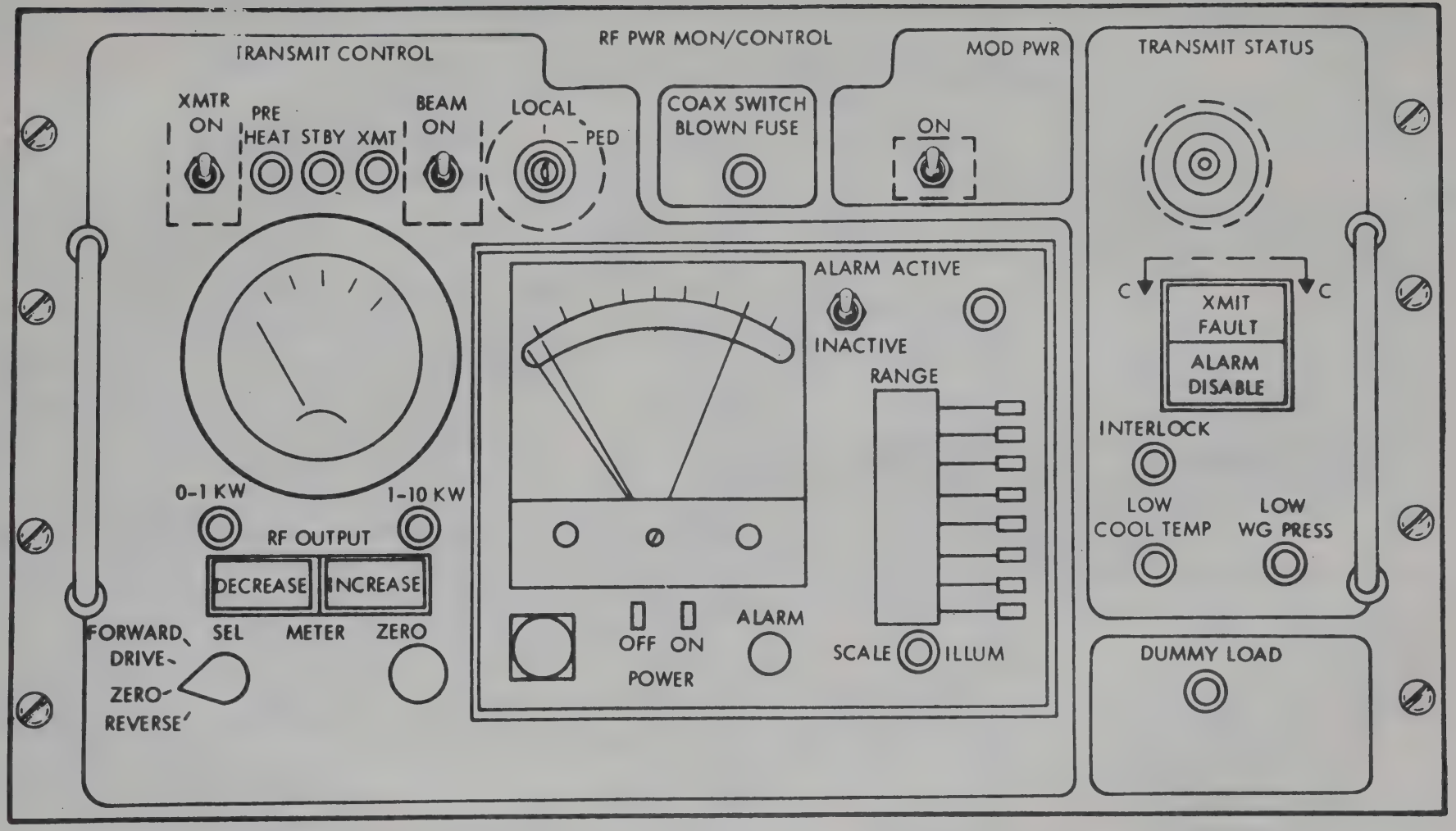

LEVEL SET ATTEN
ATTEN 1
ATTEN 2
725 MHZ
LO SEL
200
MHZ
725 MHz
CONV INPUT
LO
200 MHz
LO
725 MHz
24V
200 MHZ
CONV INP
STD LVL
5 MHz
INTL STD
70 MHz
INTL STD
STATUS SELECT
70 MHZ
ON
5 MHZ
ON
POWER
ON
POWER
ON
OFF
STATUS
RF
input
70 MHZ
test
output
RF
OUTPUT
TEST TRANSLATOR
OUTPUT
INPUT
TEST TRANSLATOR


TRANSMITTER LIQUID COOLER 2A3A3
HEAT TRANSFER SYSTEM 2A3A3A2
OUTBOARD PURITY LOOP AND FULL FLOW FILTER
TEMP GAGE
PRESSURE GAGE
TEMP CONTROL VALVE
HEAT EXCHANGER
FAN
BACK FLUSH VALVE
FILTER BY-PASS VALVE
PARTICLE-FILTER COOLANT FLOW S6
5 MICRON FILTER
FLOW METER
FLOW METER
CONDUCTIVITY CELL
DE-IONIZER
0.55 MICRON FILTER
CONTROL ORIFICE
CONDUCTIVITY CELL
15 psi RELIEF CAP
RESERVOIR
LOW LIQUID WARNING DIFFERENTIAL PRESSURE S1
LOW LIQUID INTERLOCK DIFFERENTIAL PRESSURE S2
HIGH TEMP S1
MANIFOLD
LOW TEMP S2
WAVEGUIDE AND DUMMY LOAD FLOW S4 1 GPM
BULKHEAD
1 GPM
QUICK-DISCONNECT COUPLINGS
FILTER SCREEN
COLLECTOR FLOW S5 5 GPM
BODY AND MAGNET FLOW S3 .5 GPM
TRANSMITTER PLATE ASSEMBLY 2A3A10
PRESSURE RELIEF VALVE 200 PSI
HEATER HR1
COLLECTOR
MAGNET
BODY
MAGNET
KLYSTRON AND MAGNETS A19
FLEX-GUIDE
HEAT EXCHANGER
RF REFLECTION ISOLATOR AT14
BANDPASS FILTER FL8
DUMMY AT17
WAVEGUIDE SWITCH S3
NOTES:
TS=TEMPERATURE SWITCH
PS=PRESSURE SWITCH
FS=FLOW SWITCH
EL2LE007

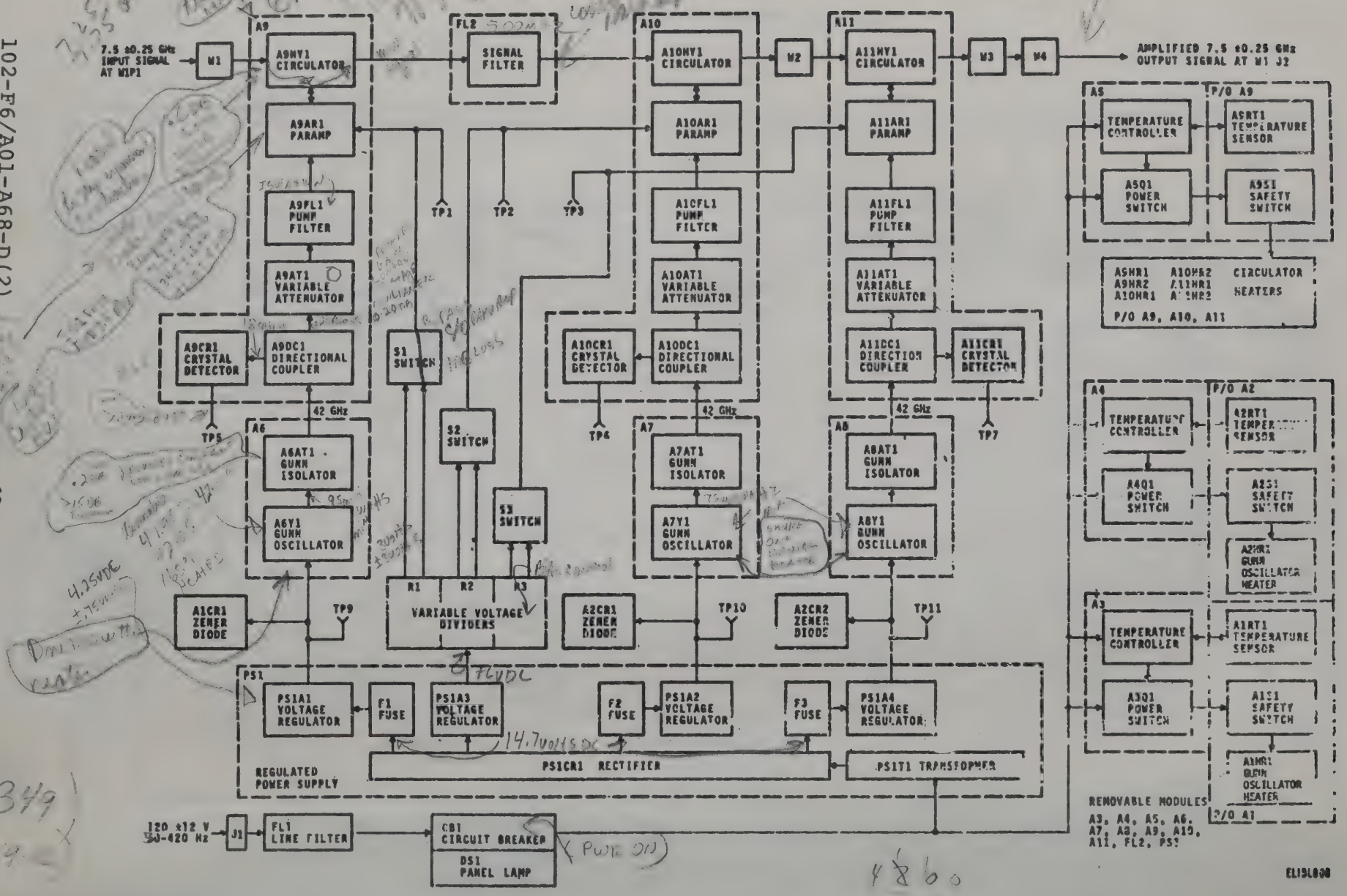

NOT PART OF AN/TSC-54
DEHYDRATOR SM-A-778163-1
SOL
WATER TRAP DUMP VALVE
MAINTENANCE PWR DIST BULKHEAD
MAINTENANCE VAN BULKHEAD
MAINTENANCE VAN
PEDESTAL
DRY AIR
NITROGEN TANK W/REGULATOR
QUICK-DISCONNECT COUPLING
SELECTOR VALVE
WAVEGUIDE
WAVEGUIDE
WAVEGUIDE
HUMIDITY INDICATOR
MANIFOLD AND FLOW METERS
BLEED VALVE
EL2LE088

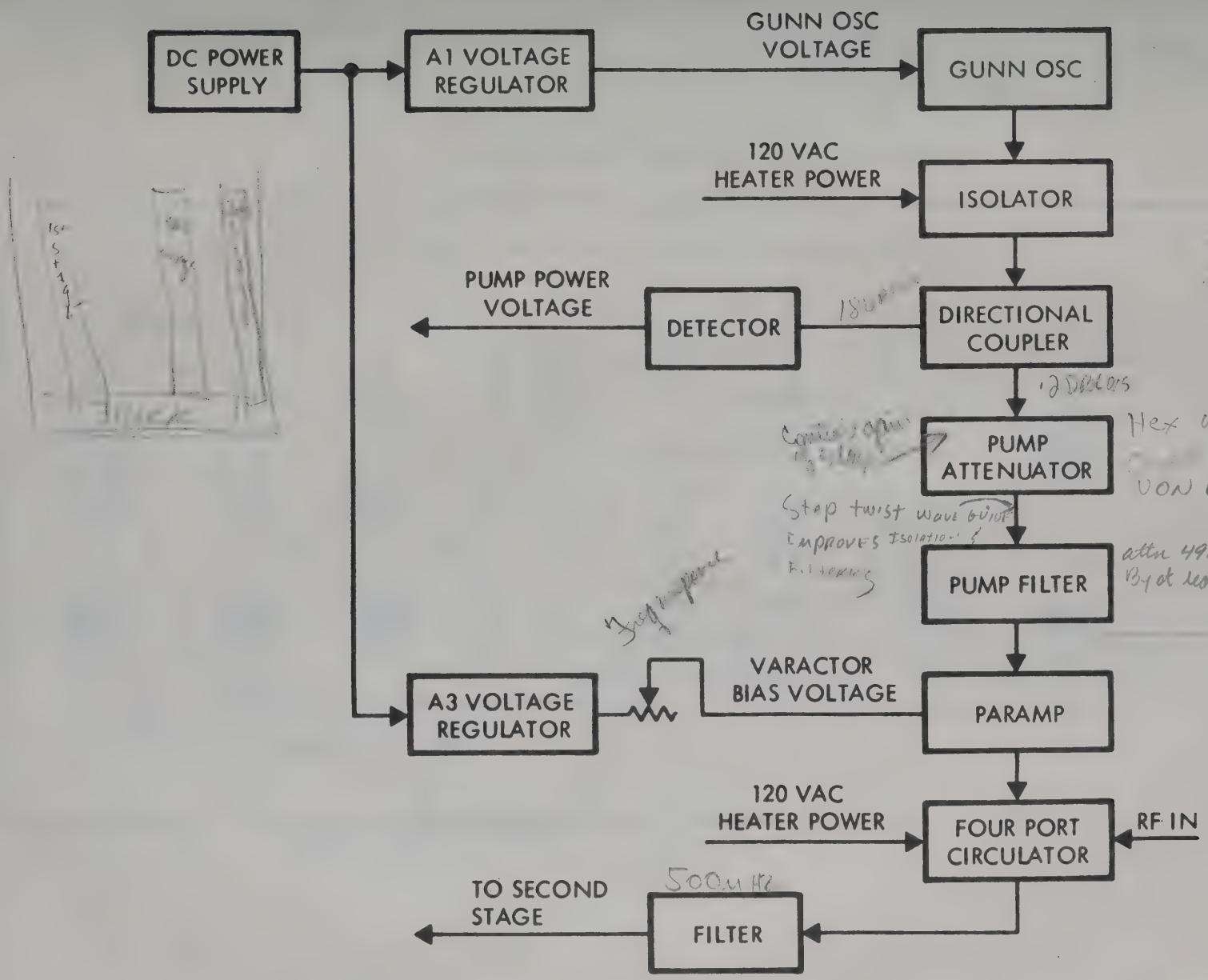


PEDESTAL TRANSMITTER CONTROL PANEL

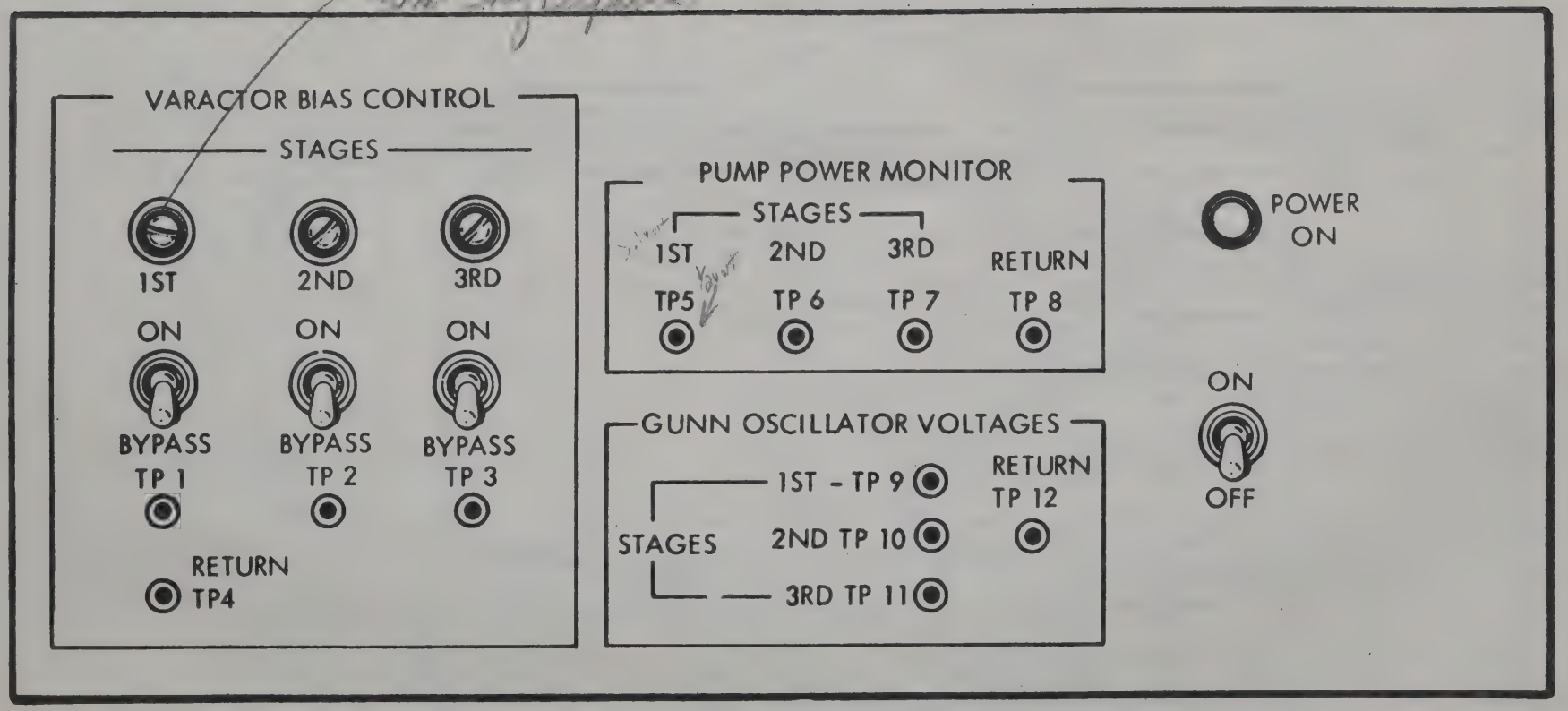


RF POWER MONITOR AND CONTROL

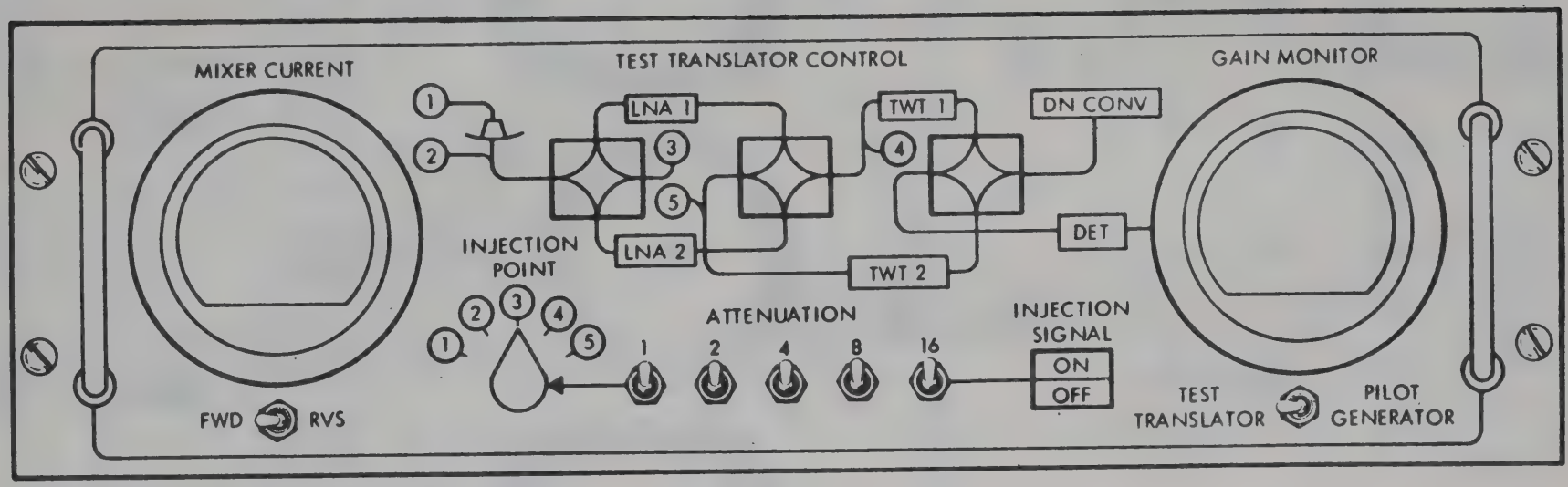

7.5 ±0.25 GHz INPUT SIGNAL AT W1P1
W1
A9
A9HY1 CIRCULATOR
A9AR1 PARAMP
A9FL1 PUMP FILTER
A9AT1 VARIABLE ATTENUATOR
A9CR1 CRYSTAL DETECTOR
A9DC1 DIRECTIONAL COUPLER
FL2
SIGNAL FILTER
A10
A10HY1 CIRCULATOR
A10AR1 PARAMP
A1CFL1 PUMP FILTER
A10AT1 VARIABLE ATTENUATOR
A10CR1 CRYSTAL DETECTOR
A10DC1 DIRECTIONAL COUPLER
W2
A11
A11HY1 CIRCULATOR
A11AR1 PARAMP
A11FL1 PUMP FILTER
A11AT1 VARIABLE ATTENUATOR
A11DC1 DIRECTION COUPLER
A11CR1 CRYSTAL DETECTOR
W3
W4
AMPLIFIED 7.5 ±0.25 GHz OUTPUT SIGNAL AT W1 J2
TP1
TP2
TP3
TP5
TP6
TP7
S1 SWITCH
S2 SWITCH
S3 SWITCH
42 GHz
A6
A6AT1 GUNN ISOLATOR
A6Y1 GUNN OSCILLATOR
A7
A7AT1 GUNN ISOLATOR
A7Y1 GUNN OSCILLATOR
A8
A8AT1 GUNN ISOLATOR
A8Y1 GUNN OSCILLATOR
R1
R2
R3
VARIABLE VOLTAGE DIVIDERS
A1CR1 ZENER DIODE
A2CR1 ZENER DIODE
A2CR2 ZENER DIODE
TP9
TP10
TP11
PS1
PS1A1 VOLTAGE REGULATOR
F1 FUSE
PS1A3 VOLTAGE REGULATOR
F2 FUSE
PS1A2 VOLTAGE REGULATOR
F3 FUSE
PS1A4 VOLTAGE REGULATOR
PS1CR1 RECTIFIER
PS1T1 TRANSFORMER
REGULATED POWER SUPPLY
120 ±12 V 50-420 Hz
J1
FL1 LINE FILTER
CB1 CIRCUIT BREAKER
DS1 PANEL LAMP
A5
TEMPERATURE CONTROLLER
A5Q1 POWER SWITCH
P/O A9
A5RT1 TEMPERATURE SENSOR
A5S1 SAFETY SWITCH
A5HR1 A9HR2 A10HR1 A10HR2 A11HR1 A11HR2 CIRCULATOR HEATERS
P/O A9, A10, A11
A4
TEMPERATURE CONTROLLER
A4Q1 POWER SWITCH
P/O A2
A2RT1 TEMPERATURE SENSOR
A2S1 SAFETY SWITCH
A2HR1 GUNN OSCILLATOR HEATER
A3
TEMPERATURE CONTROLLER
A3Q1 POWER SWITCH
P/O A1
A1RT1 TEMPERATURE SENSOR
A1S1 SAFETY SWITCH
A1HR1 GUNN OSCILLATOR HEATER
REMOVABLE MODULES
A3, A4, A5, A6, A7, A8, A9, A10, A11, FL2, PS1
EL19L000



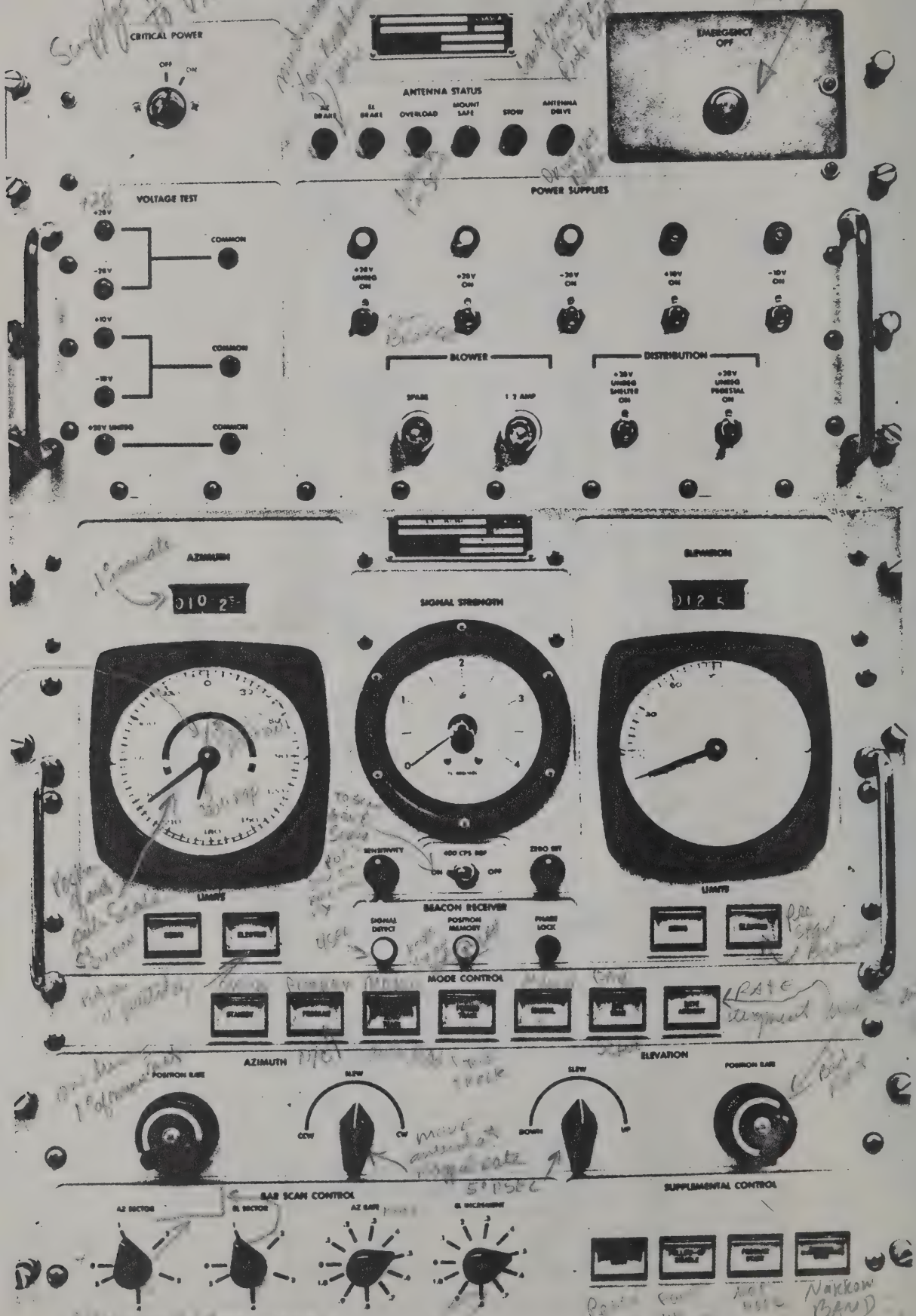
PARAMETRIC AMPLIFIER, FUNCTIONAL DIAGRAM



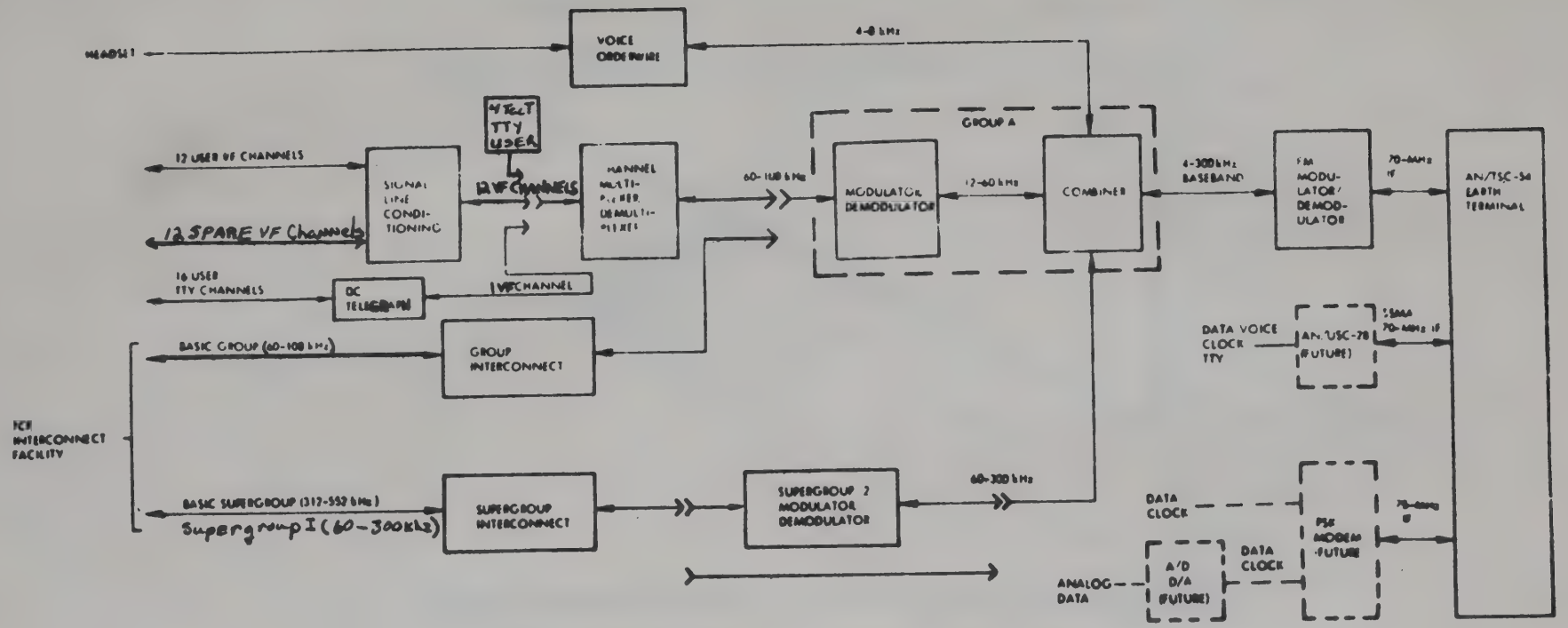
PARAMETRIC AMPLIFIER CONTROL PANEL



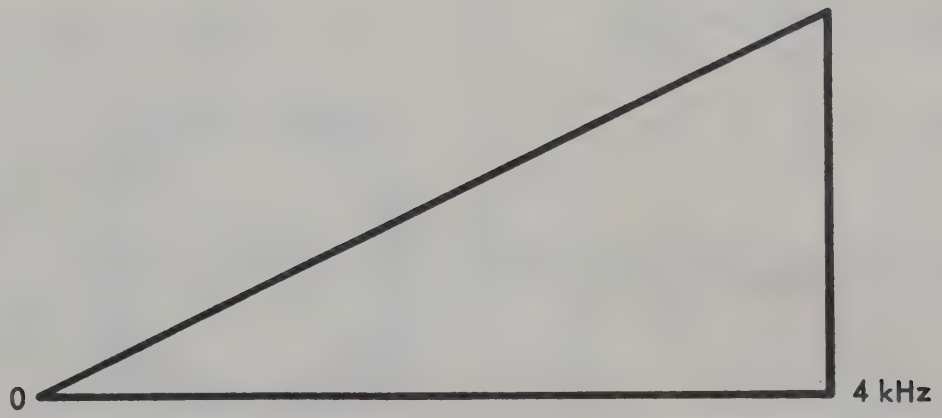
TEST TRANSLATOR CONTROL PANEL

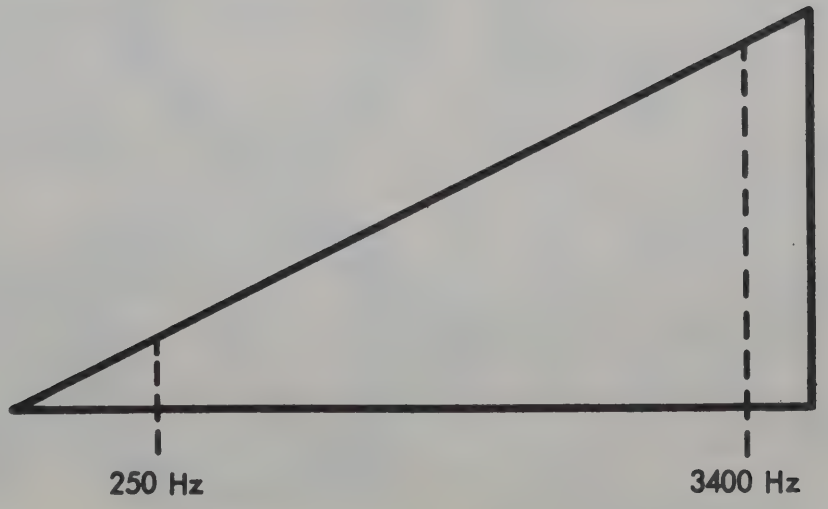


ANTENNA CONTROL PANEL

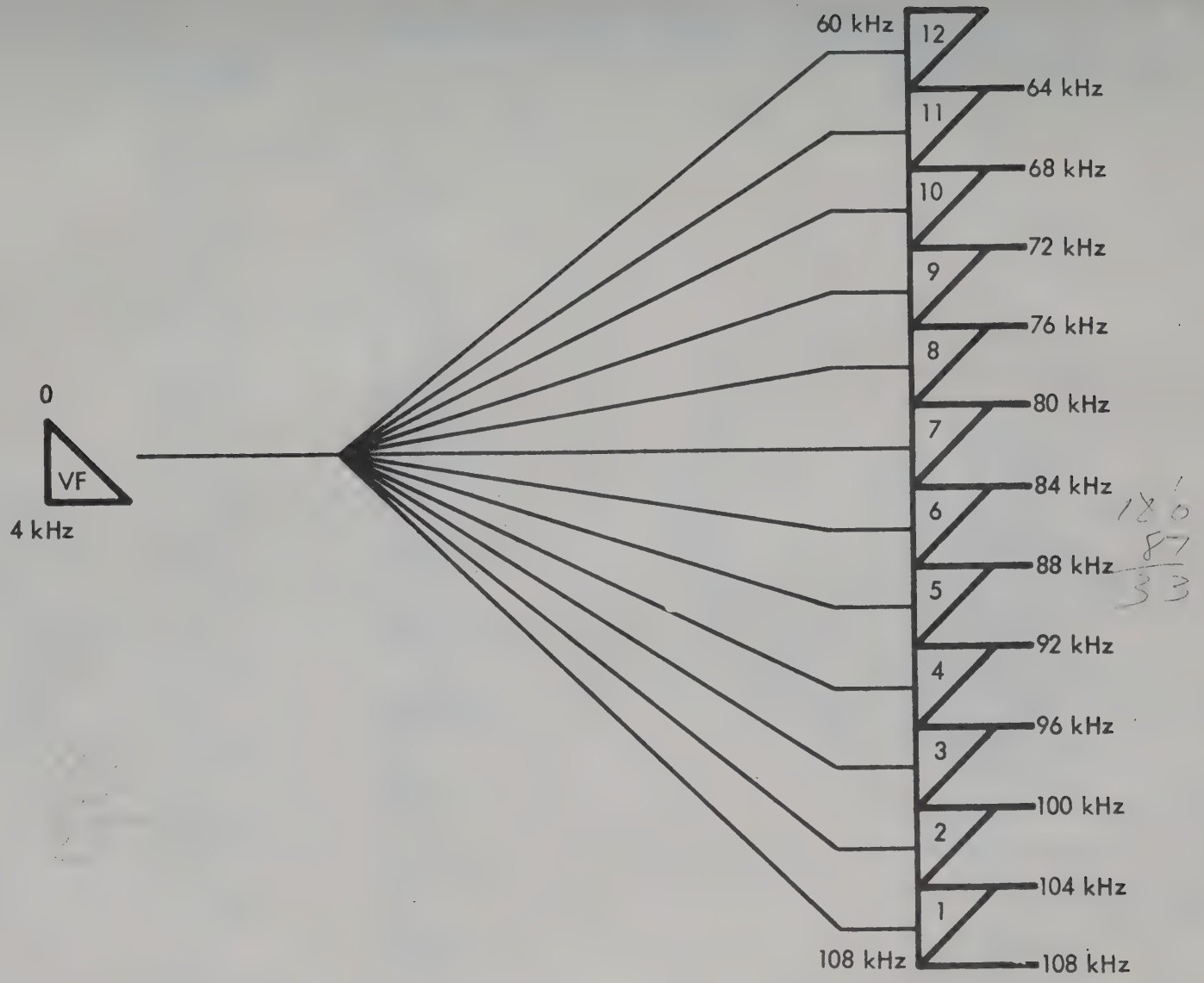


MULTIPLEXER SET AN/TCC-79 SIMPLIFIED BLOCK DIAGRAM

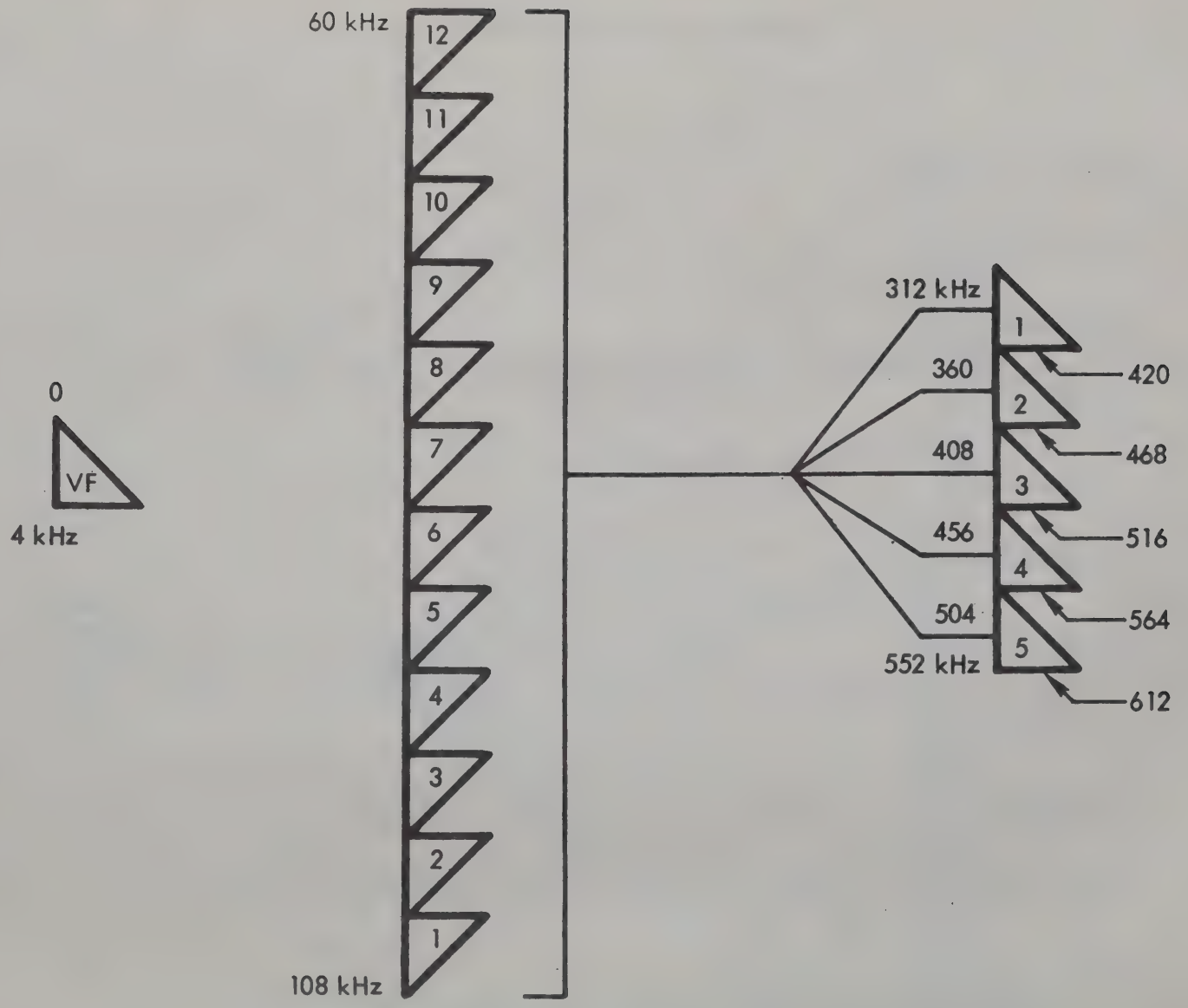




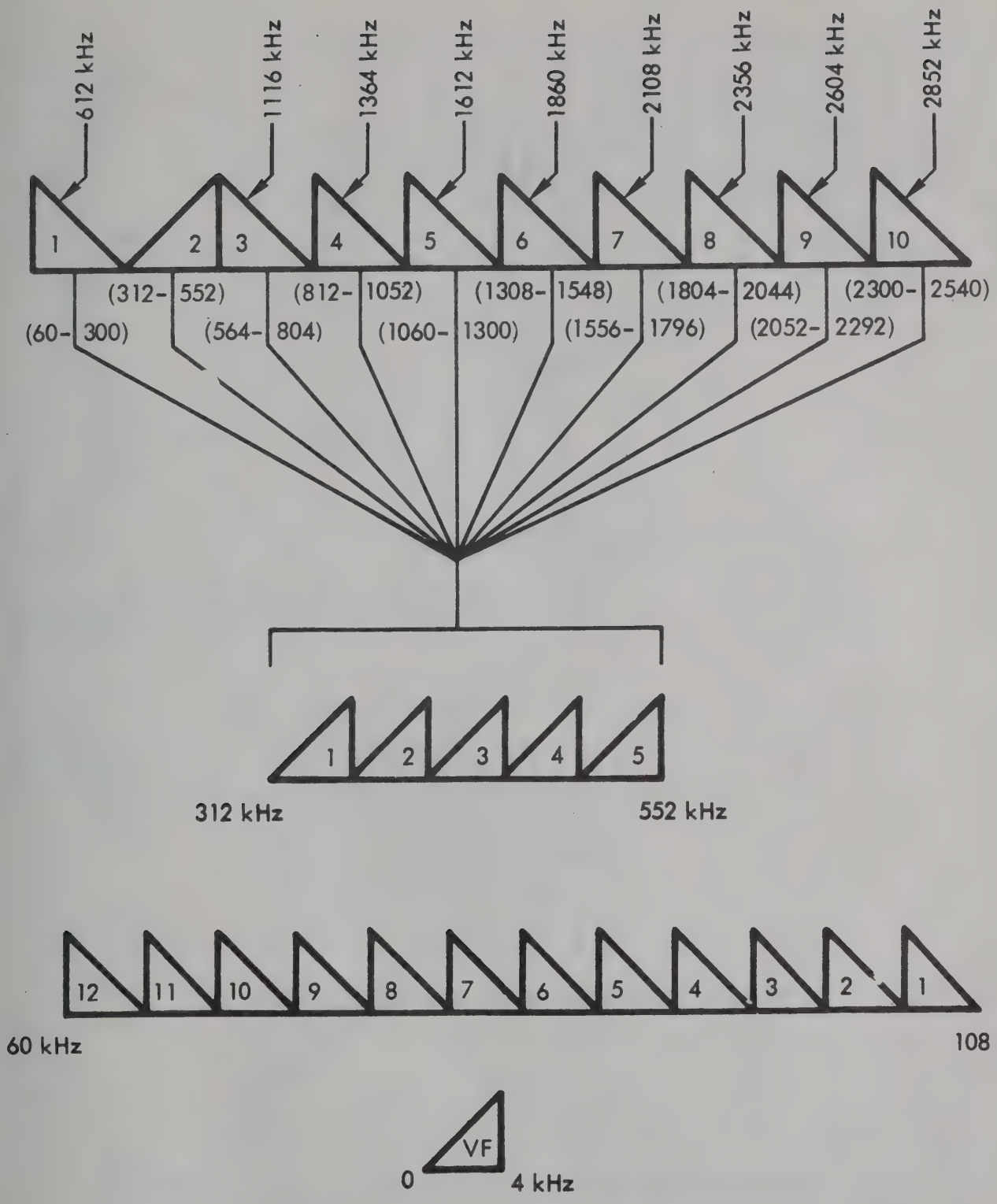
TYPICAL VOICE CHANNEL FREQUENCY



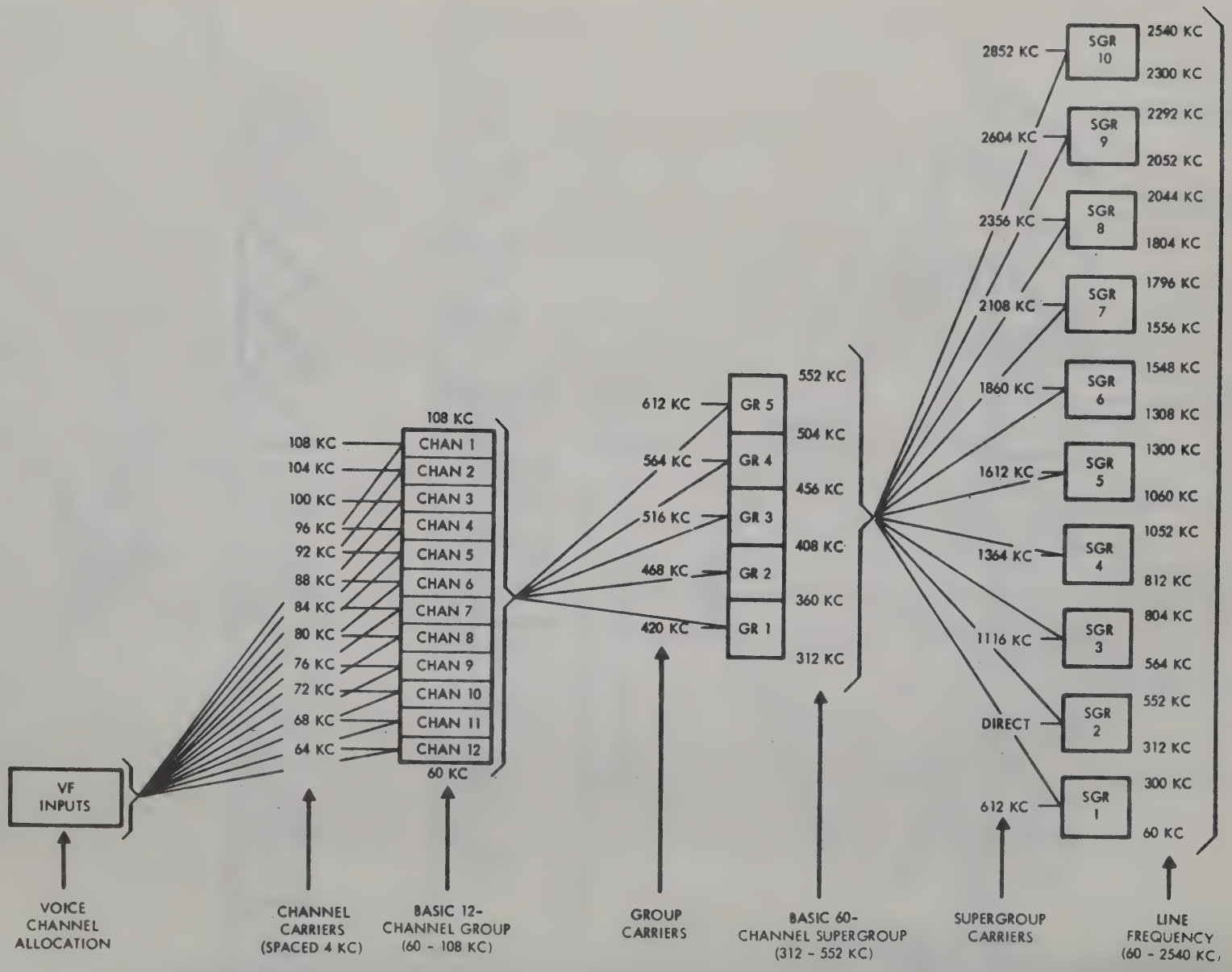
CHANNEL TO GROUP CONVERSION



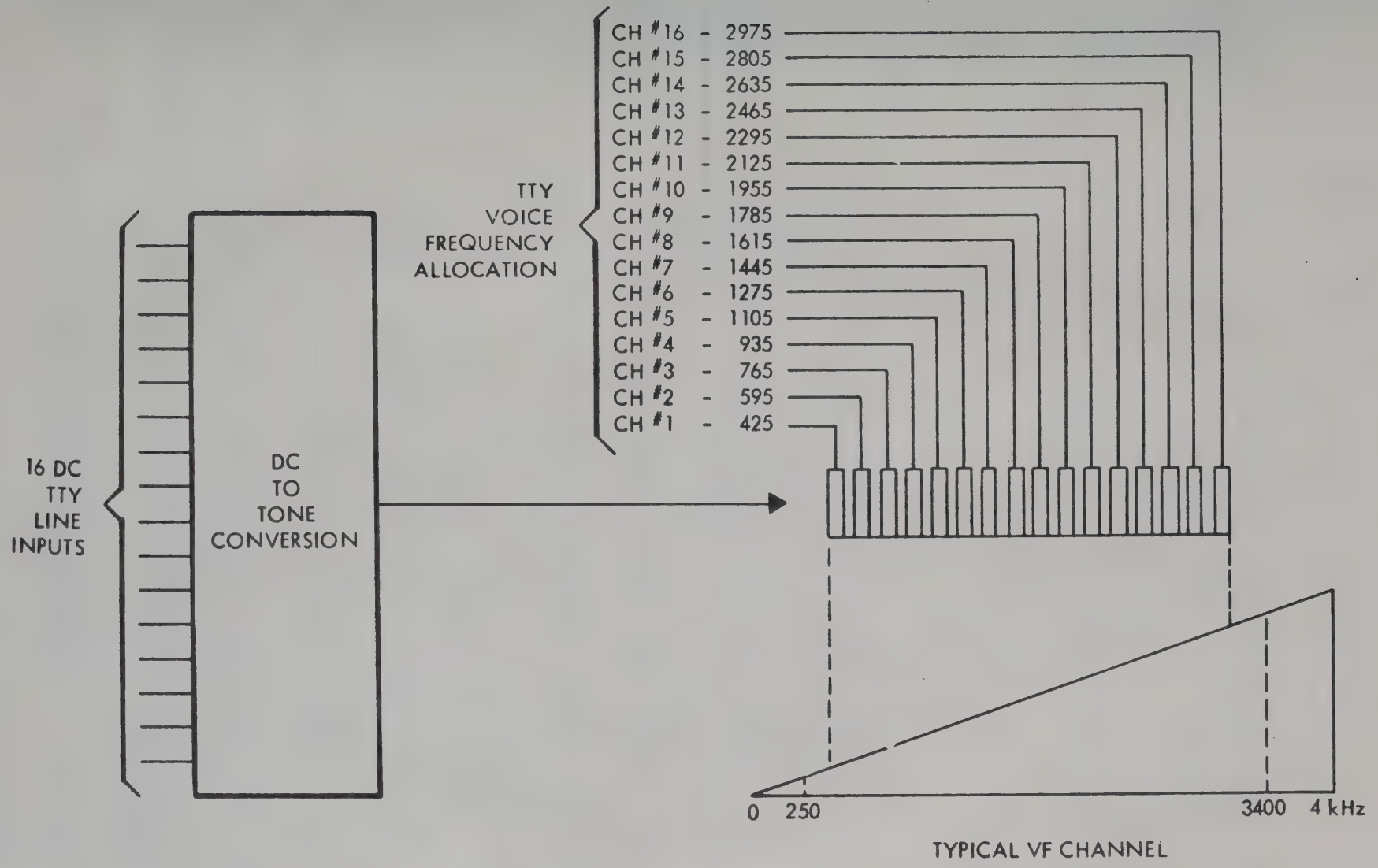
CHANNEL TO SUPER GROUP CONVERSION



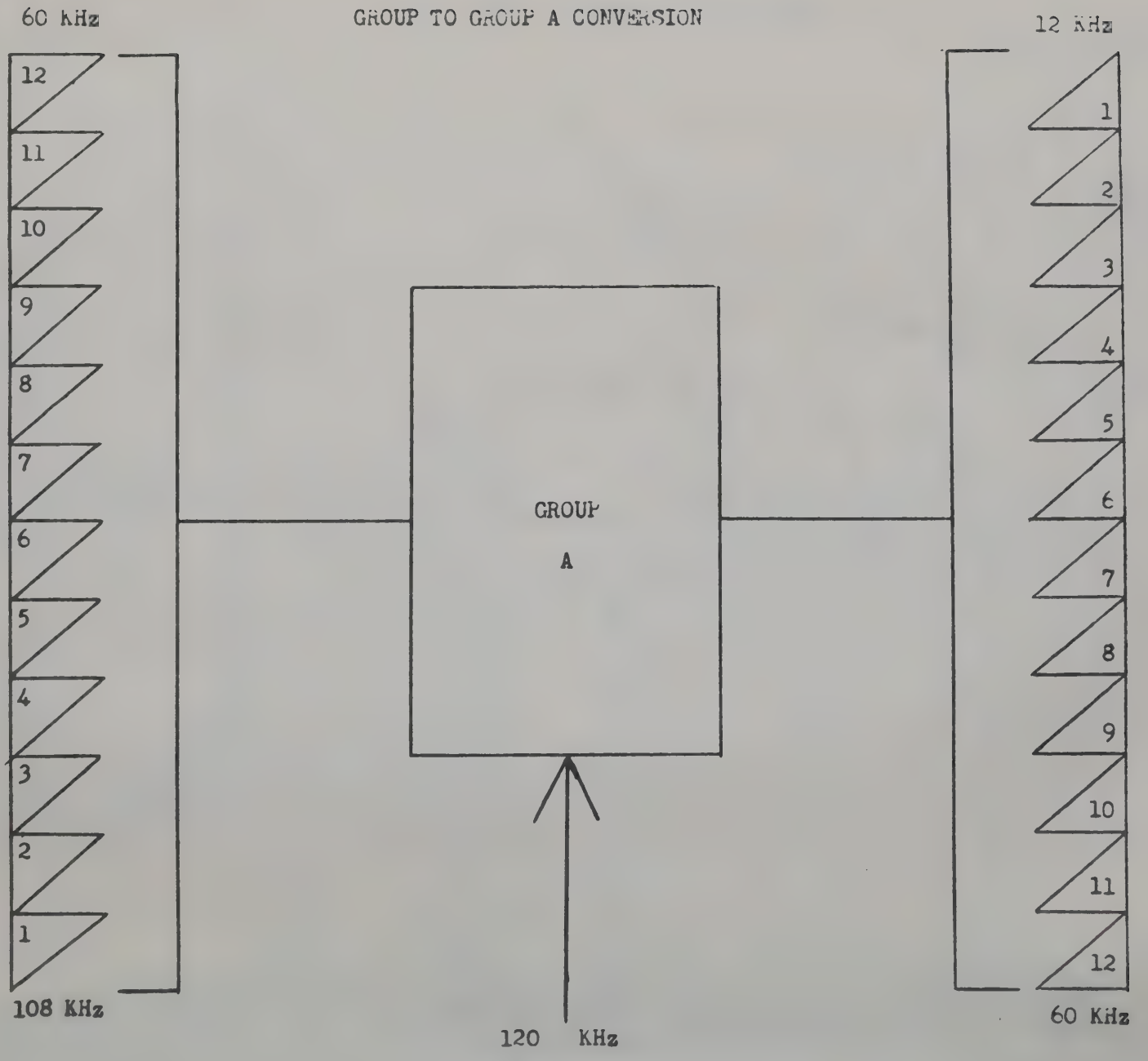
CHANNEL TO MASTER GROUP CONVERSION

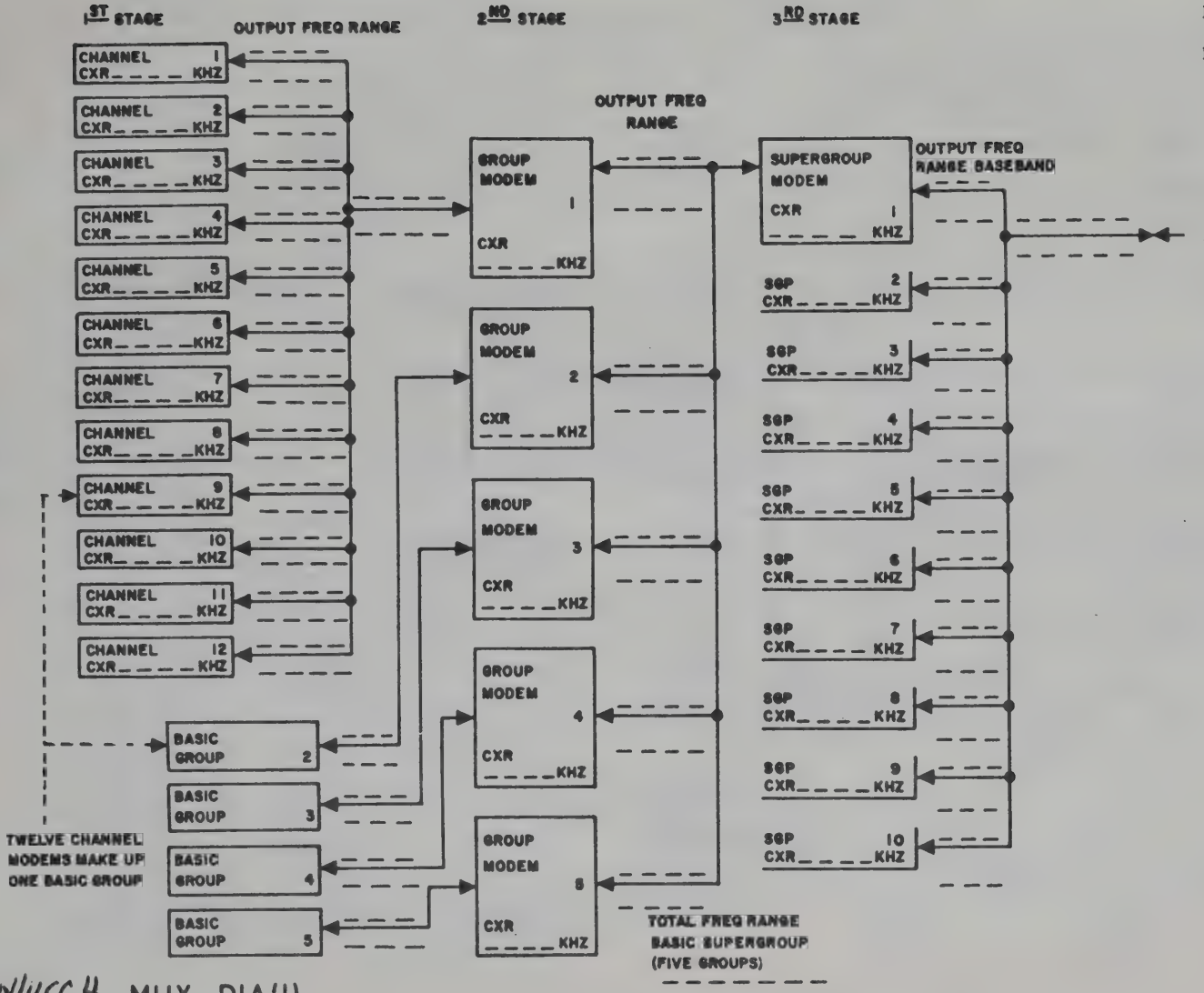

VF INPUTS
VOICE CHANNEL ALLOCATION
108 KC
108 KC CHAN 1
104 KC CHAN 2
100 KC CHAN 3
96 KC CHAN 4
92 KC CHAN 5
88 KC CHAN 6
84 KC CHAN 7
80 KC CHAN 8
76 KC CHAN 9
72 KC CHAN 10
68 KC CHAN 11
64 KC CHAN 12
60 KC
CHANNEL CARRIERS (SPACED 4 KC)
BASIC 12-CHANNEL GROUP (60 - 108 KC)
612 KC GR 5
564 KC GR 4
516 KC GR 3
468 KC GR 2
420 KC GR 1
GROUP CARRIERS
552 KC
504 KC
456 KC
408 KC
360 KC
312 KC
BASIC 60-CHANNEL SUPERGROUP (312 - 552 KC)
2852 KC SGR 10 2540 KC 2300 KC
2604 KC SGR 9 2292 KC 2052 KC
2356 KC SGR 8 2044 KC 1804 KC
2108 KC SGR 7 1796 KC 1556 KC
1860 KC SGR 6 1548 KC 1308 KC
1612 KC SGR 5 1300 KC 1060 KC
1364 KC SGR 4 1052 KC 812 KC
1116 KC SGR 3 804 KC 564 KC
DIRECT SGR 2 552 KC 312 KC
612 KC SGR 1 300 KC 60 KC
SUPERGROUP CARRIERS
LINE FREQUENCY (60 - 2540 KC)

FREQUENCY ALLOCATION AND MODULATION PLAN



TTY VOICE FREQUENCY ALLOCATION


GROUP TO GROUP A CONVERSION
60 KHz
12
11
10
9
8
7
6
5
4
3
2
1
108 KHz
GROUP
A
120 KHz
12 KHz
1
2
3
4
5
6
7
8
9
10
11
12
60 KHz


1ST STAGE
OUTPUT FREQ RANGE
2ND STAGE
OUTPUT FREQ RANGE
3RD STAGE
OUTPUT FREQ RANGE BASEBAND
CHANNEL 1 CXR ____ KHZ
CHANNEL 2 CXR ____ KHZ
CHANNEL 3 CXR ____ KHZ
CHANNEL 4 CXR ____ KHZ
CHANNEL 5 CXR ____ KHZ
CHANNEL 6 CXR ____ KHZ
CHANNEL 7 CXR ____ KHZ
CHANNEL 8 CXR ____ KHZ
CHANNEL 9 CXR ____ KHZ
CHANNEL 10 CXR ____ KHZ
CHANNEL 11 CXR ____ KHZ
CHANNEL 12 CXR ____ KHZ
GROUP MODEM 1 CXR ____ KHZ
GROUP MODEM 2 CXR ____ KHZ
GROUP MODEM 3 CXR ____ KHZ
GROUP MODEM 4 CXR ____ KHZ
GROUP MODEM 5 CXR ____ KHZ
SUPERGROUP MODEM CXR 1 ____ KHZ
SGP 2 CXR ____ KHZ
SGP 3 CXR ____ KHZ
SGP 4 CXR ____ KHZ
SGP 5 CXR ____ KHZ
SGP 6 CXR ____ KHZ
SGP 7 CXR ____ KHZ
SGP 8 CXR ____ KHZ
SGP 9 CXR ____ KHZ
SGP 10 CXR ____ KHZ
BASIC GROUP 2
BASIC GROUP 3
BASIC GROUP 4
BASIC GROUP 5
TWELVE CHANNEL MODEMS MAKE UP ONE BASIC GROUP
TOTAL FREQ RANGE BASIC SUPERGROUP (FIVE GROUPS)

EQUIPMENT.....(NOTE 4)

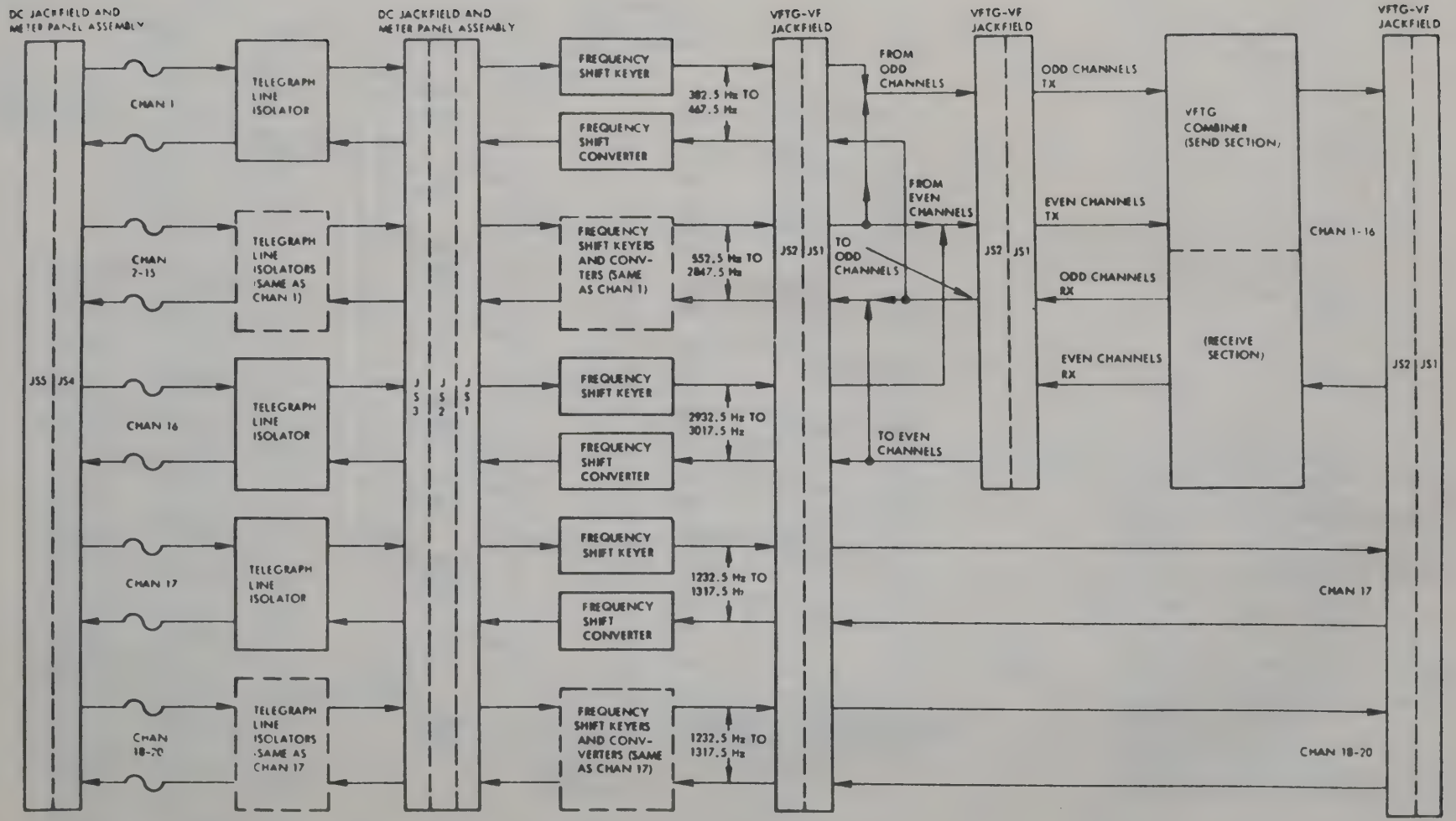
NOTES:

1. Any number of blocks may be added or deleted dependent upon the number of channels used.
2. This chart may be used for either transmit or receive.
3. Voice frequency input to all channels is ..... to .....
4. AN/FCC-17 does not use "MODEMS" as such.

PROBLEM:

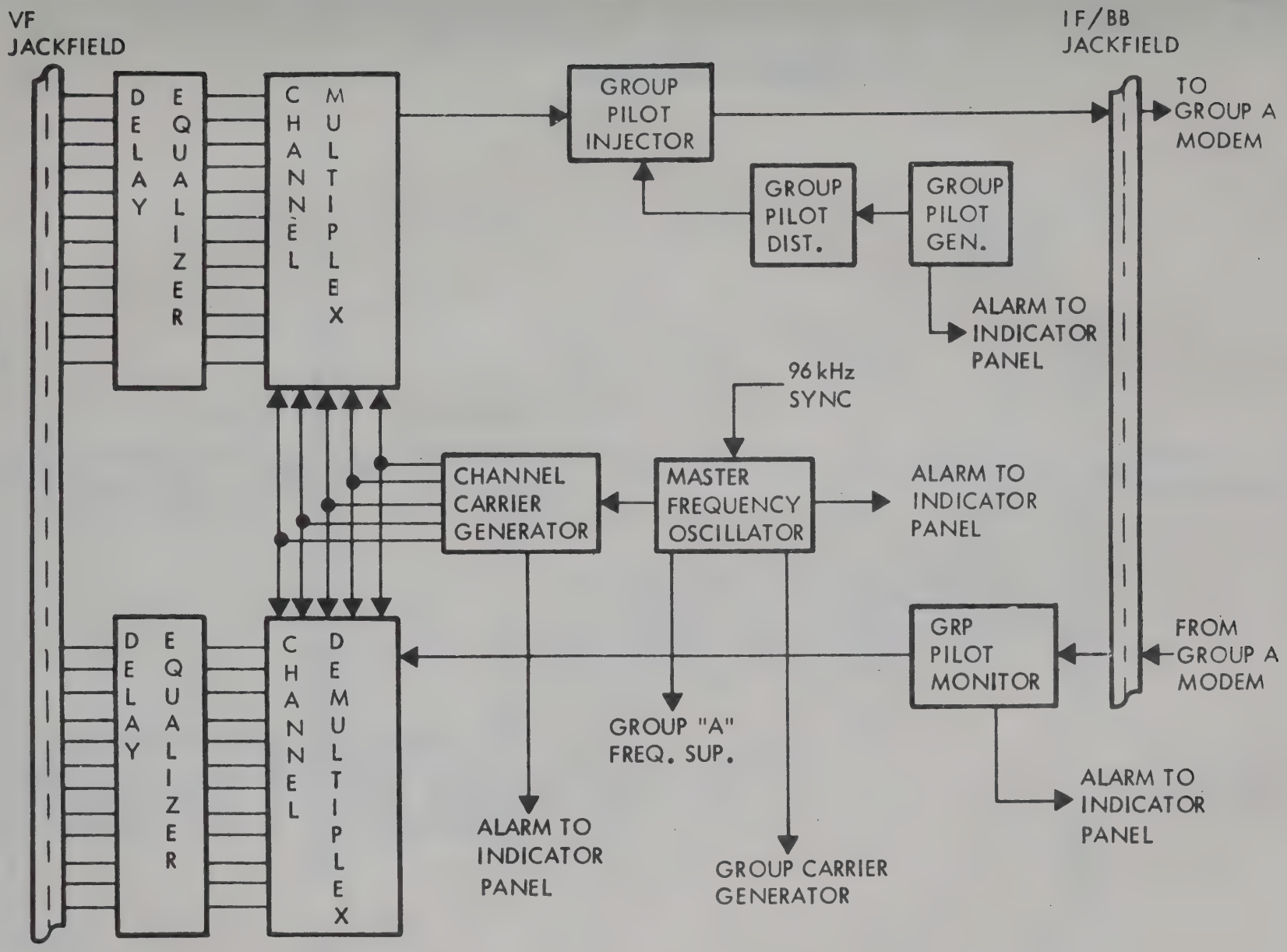
1. Fill in all correct frequencies for carriers and output frequency ranges.
2. Insert sync pilot input point with correct frequency.
3. Indicate signaling frequency used .....Hz.

AN/UCC 4 – MUX – DIA(1)

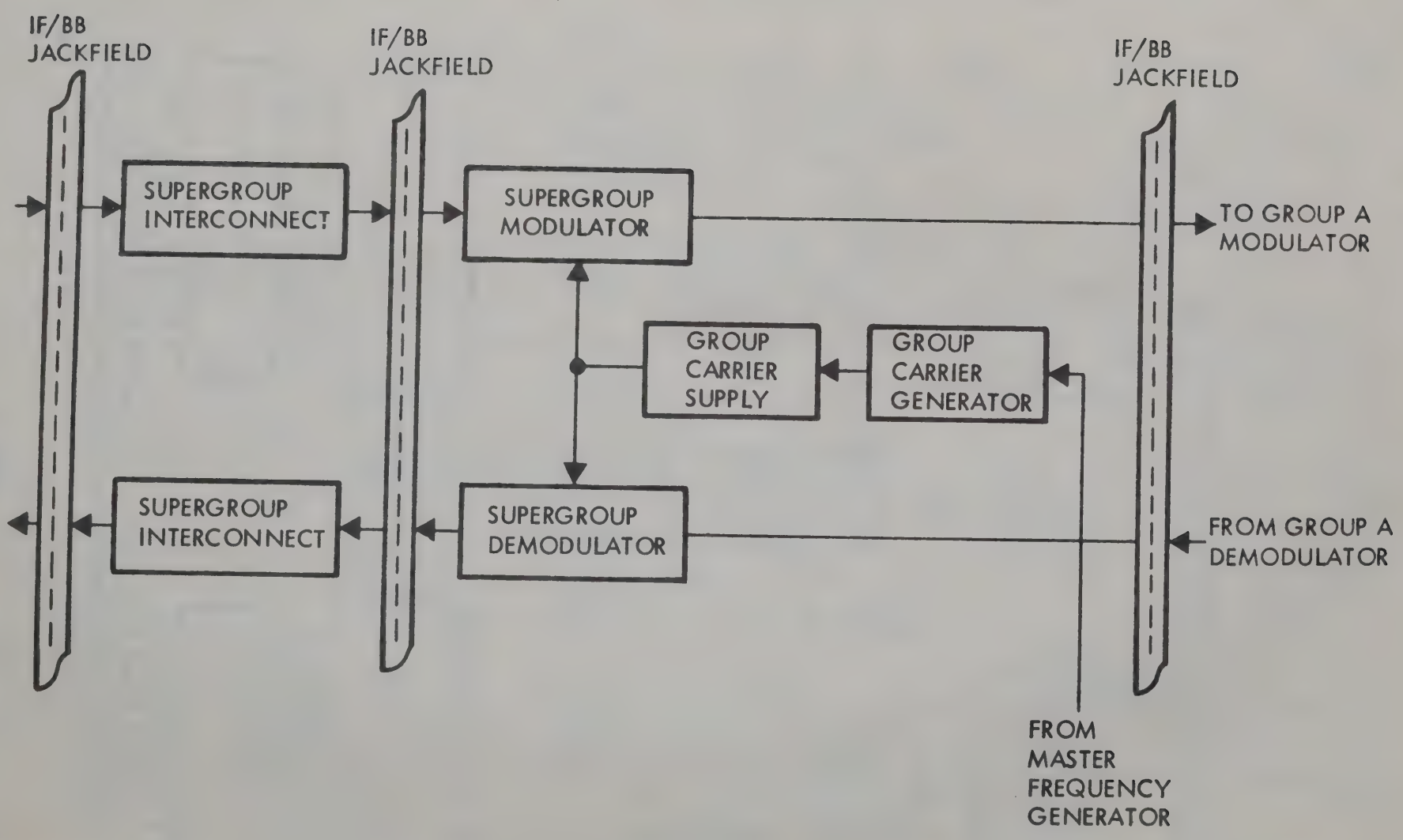


20-CHANNEL, FULL-DUPLEX CONFIGURATION

DC TELEGRAPH EQUIPMENT CONFIGURATIONS, BLOCK DIAGRAMS



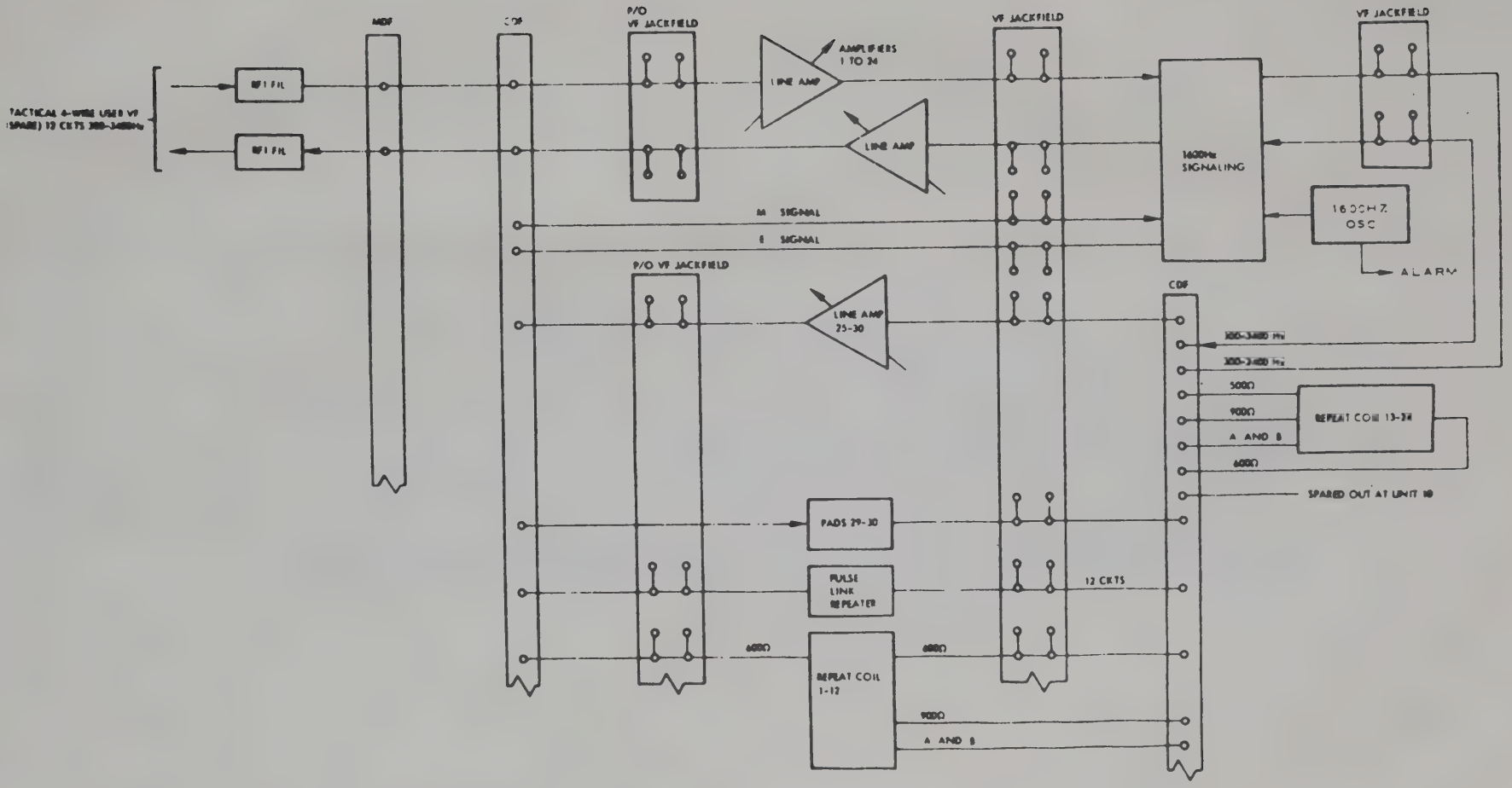
CHANNEL MULTIPLEX/DEMULTIPLEX



SUPERGROUP INTERCONNECT

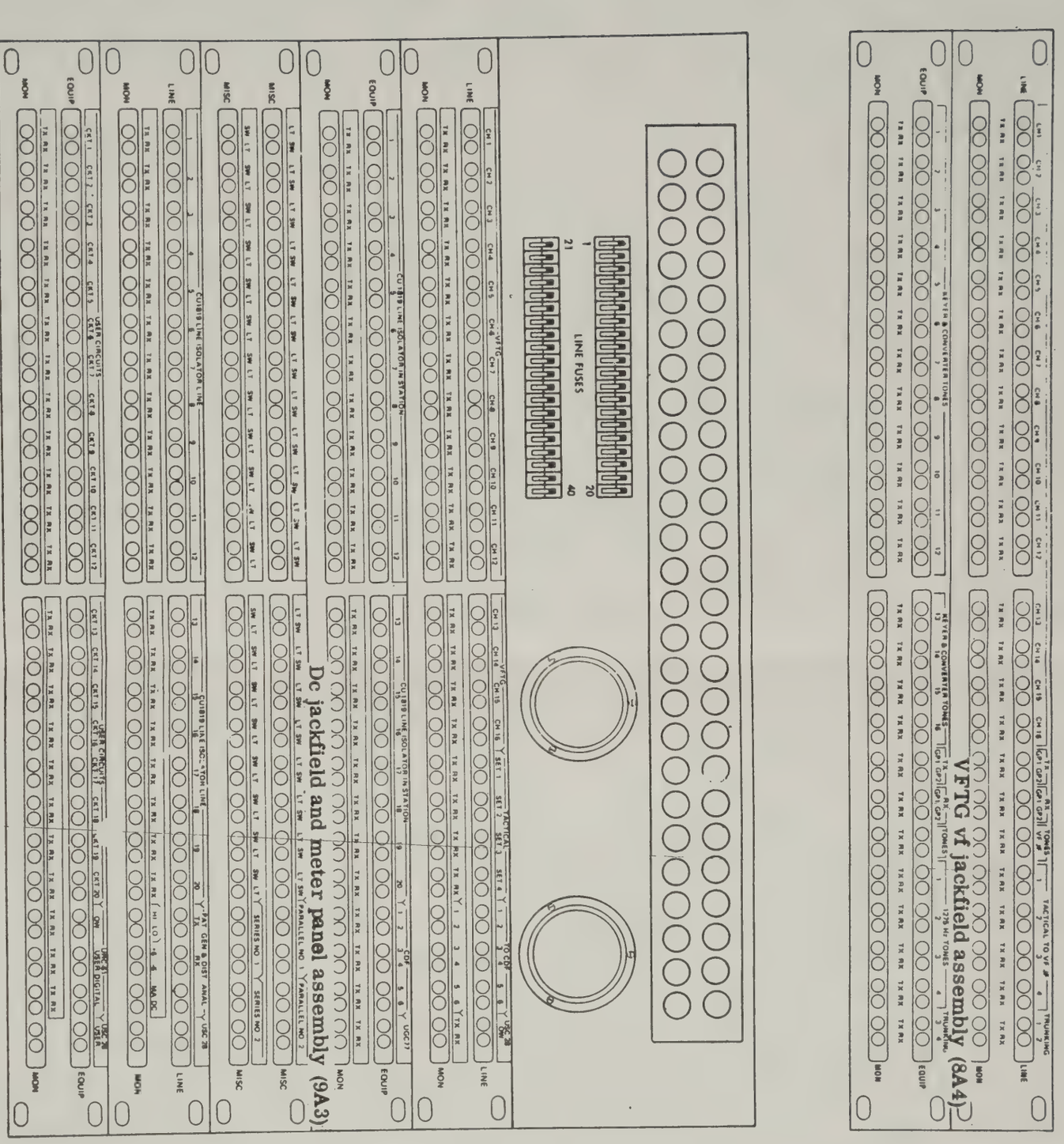
VOICE ORDERWIRE FUNCTIONAL BLOCK DIAGRAM

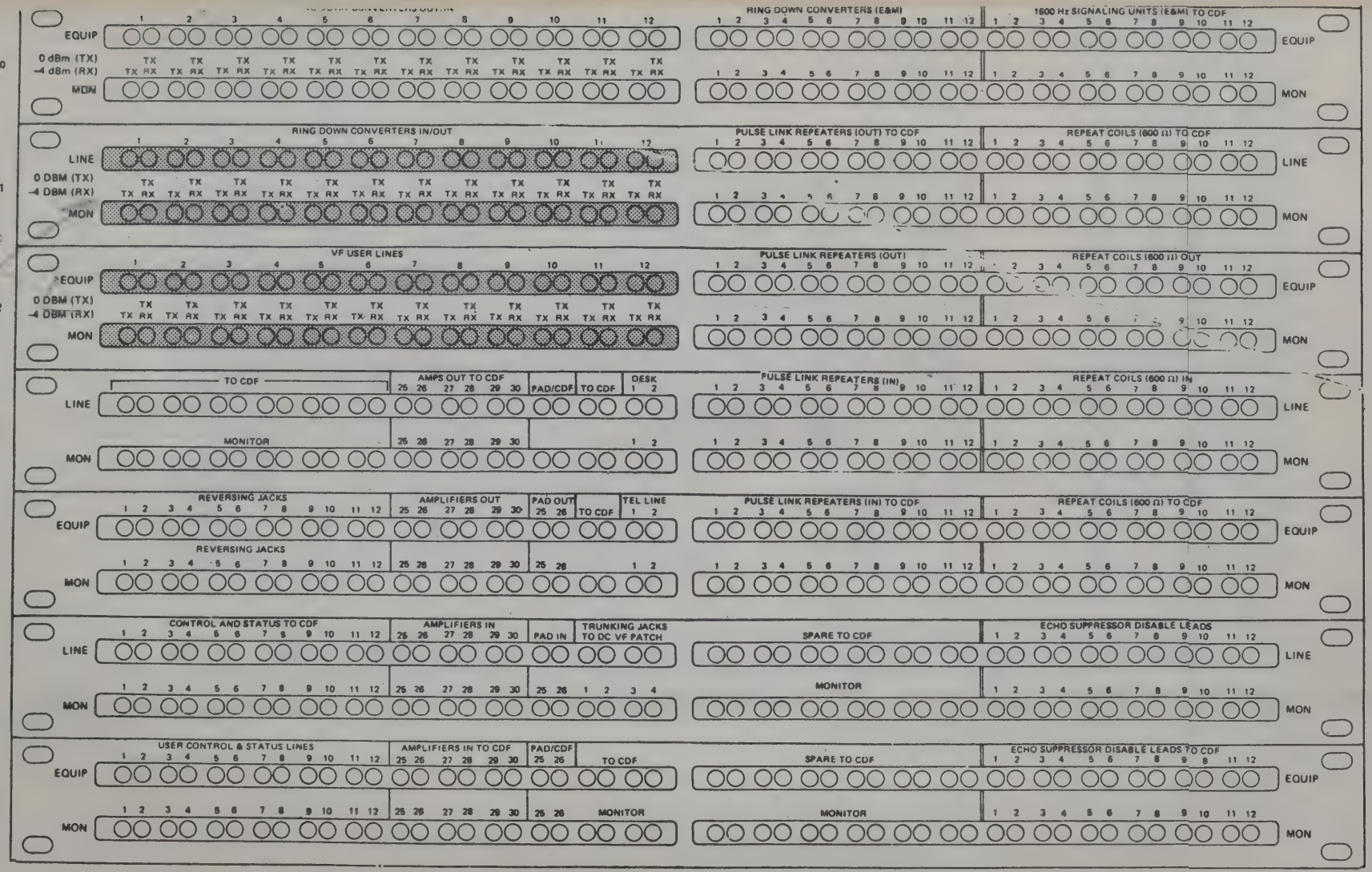
LINE CONDITIONING EQUIPMENT



2 AND 4 WIRE FUNCTIONAL BLOCK DIAGRAMS

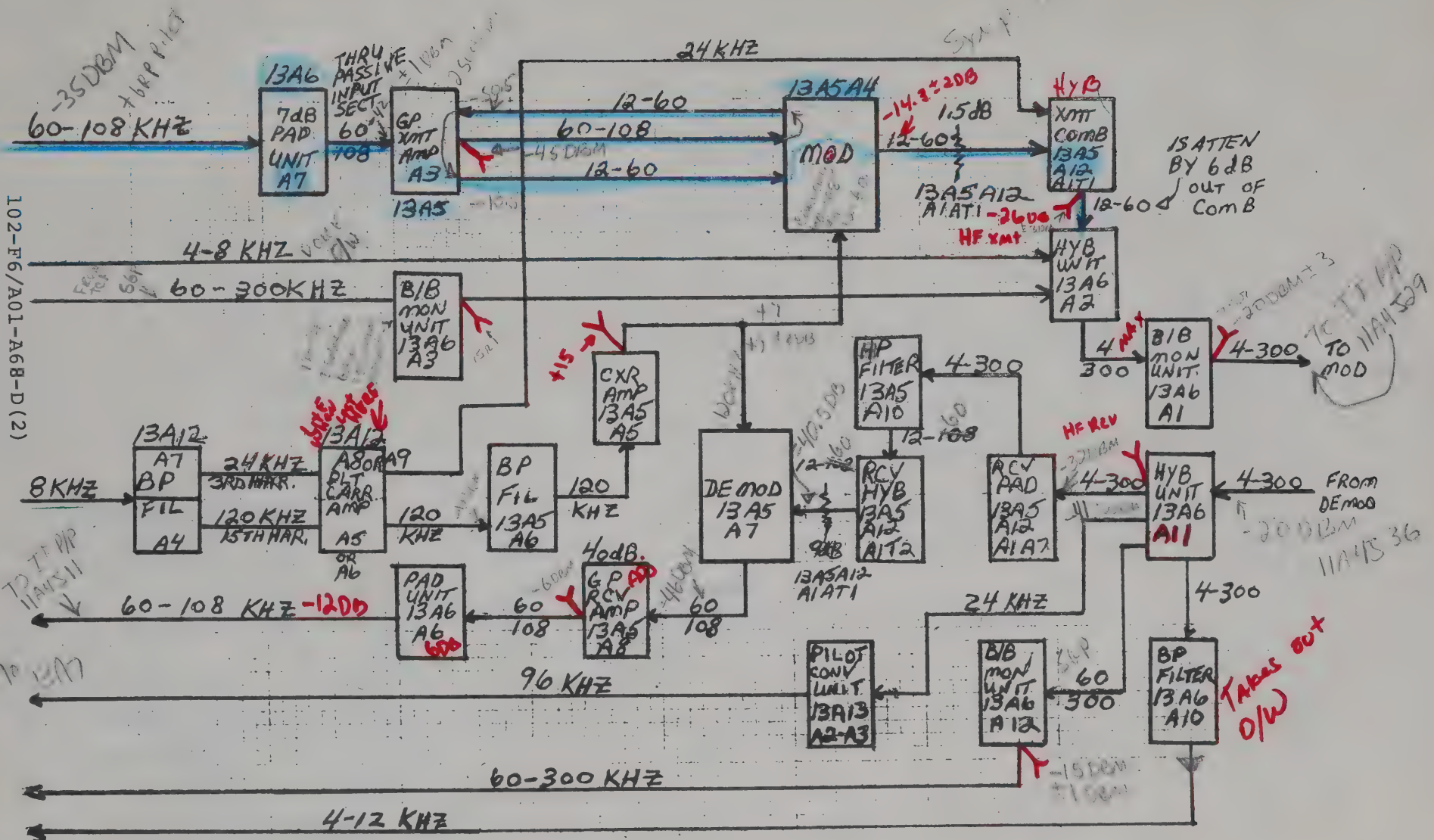
N/TCC-79 JACKFIELDS


VFTG vf jackfield assembly (8A4)
Dc jackfield and meter panel assembly (9A3)
LINE FUSES
1
20
21
40
IF/BB patch assembly (11A3, A4)
(11A3)
(11A4)
JACK NOT EQUIPPED
NC NORMAL THROUGH YOU MUST PATCH

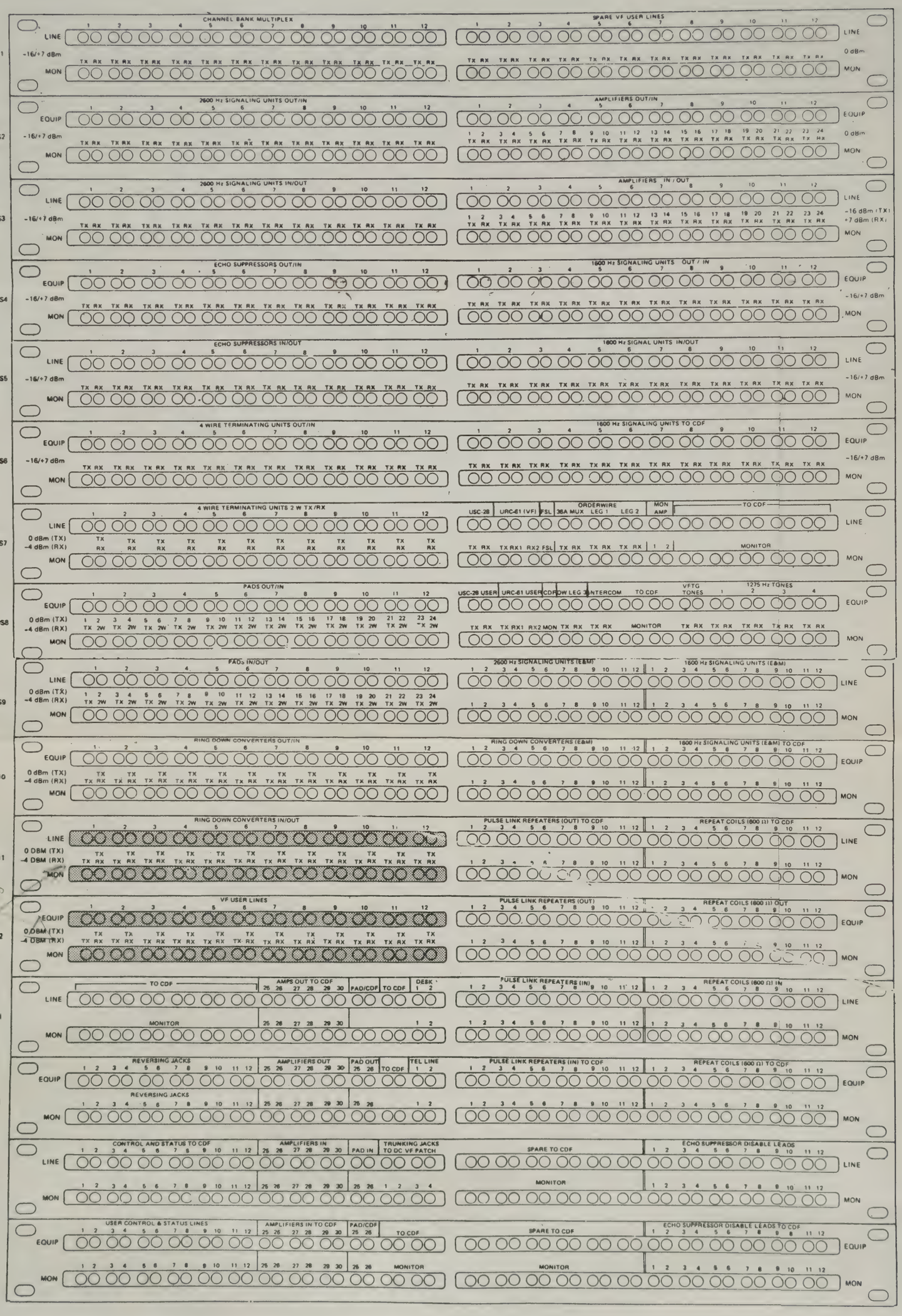


85 ts
115V AC
20HZ

AN/TCC-79
JACKFIELD ASSEMBLY (6A2)

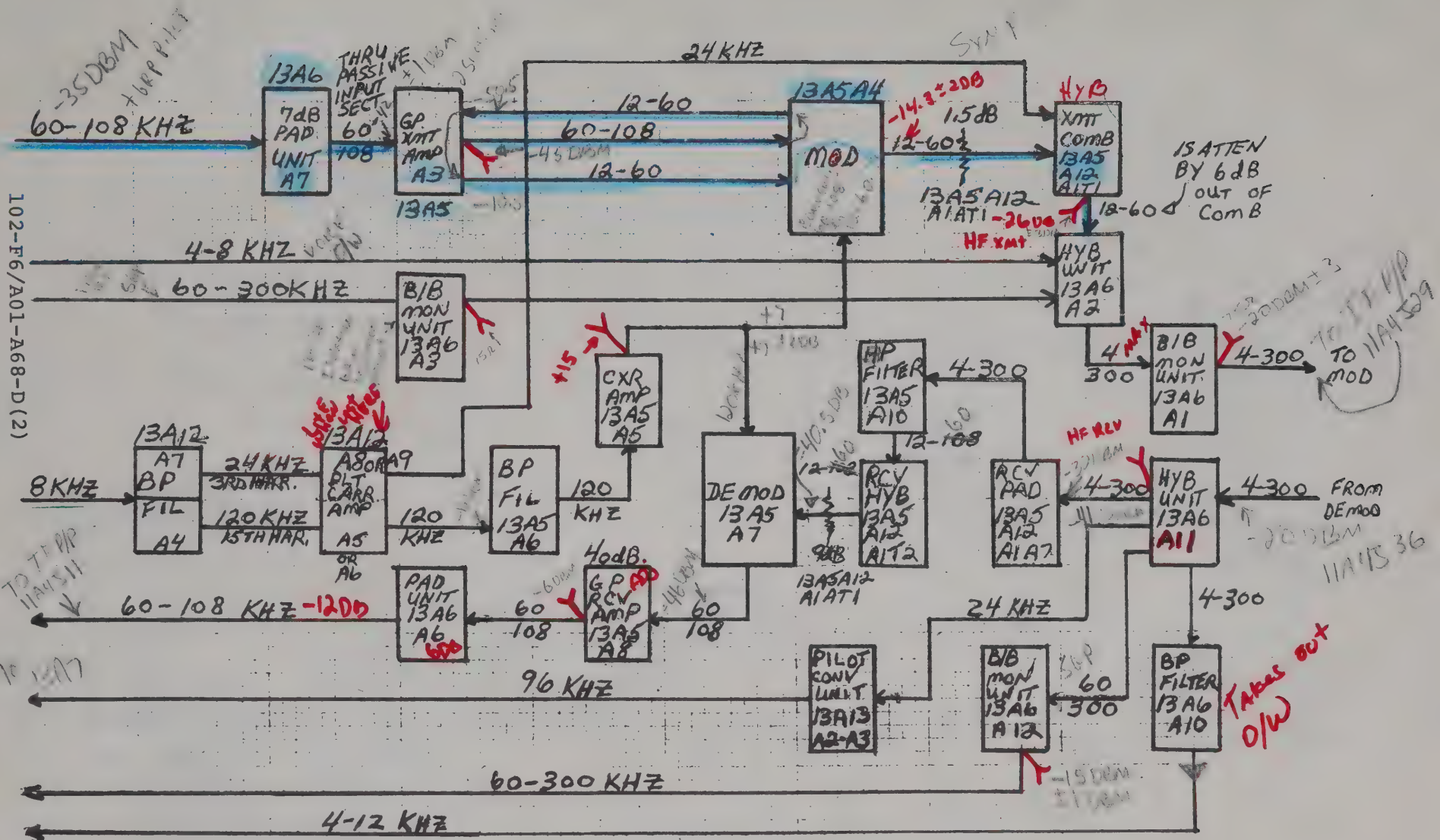


102-F6/A01-A68-D(2)

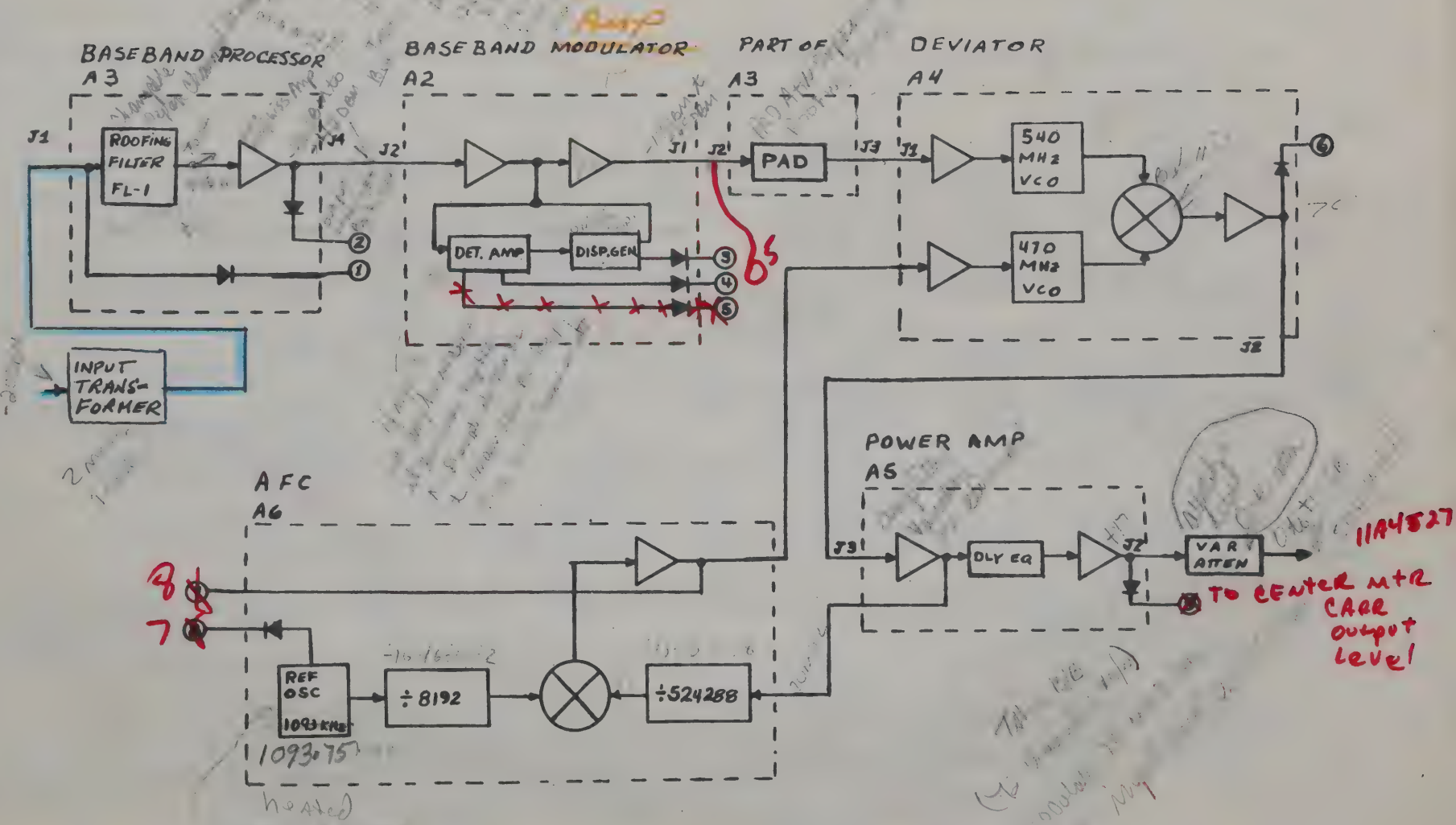


102-F6/A01-A68-D(2)

AN/TCC-79
JACKFIELD ASSEMBLY (6A2)



102-F6/A01-A68-D(2)



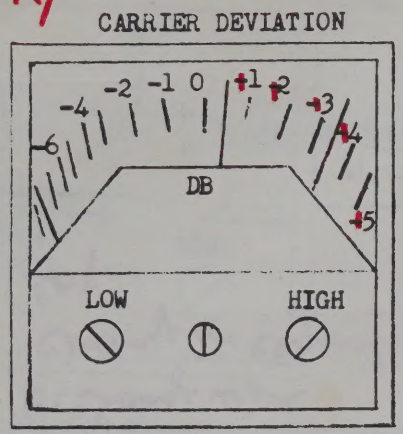
FM Modulator, simplified functional diagram

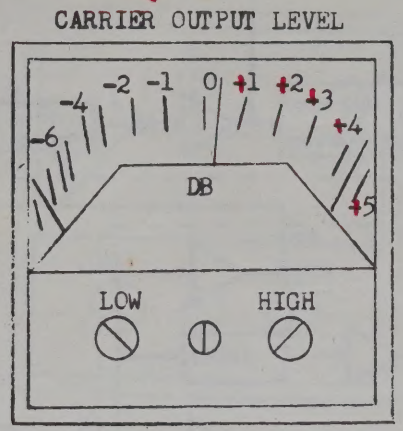
DTM 11-5895-796-34-1

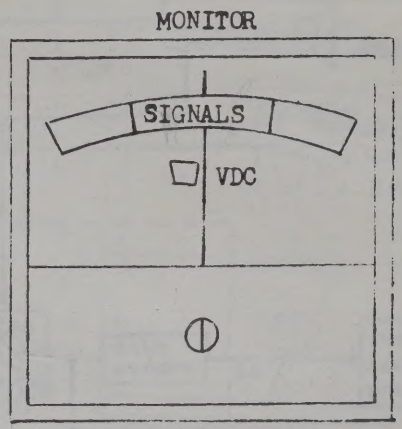
-2
-3
-1
-5
-6
3 Covers other opt.

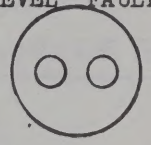
Keep on D

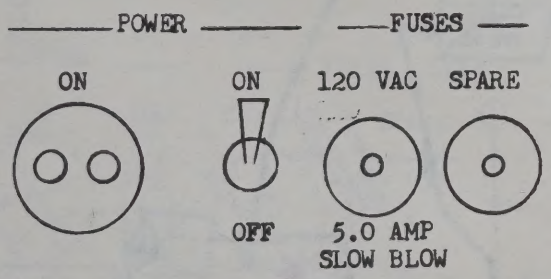
±3DB

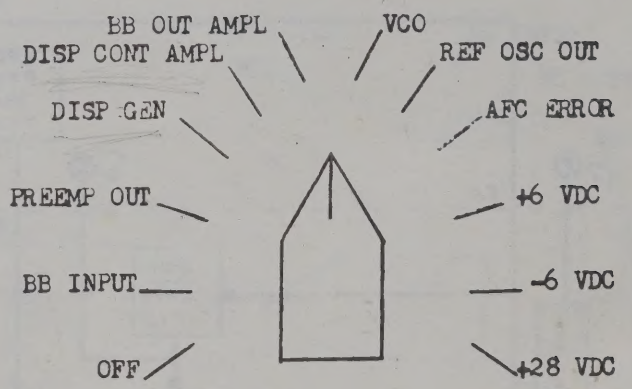




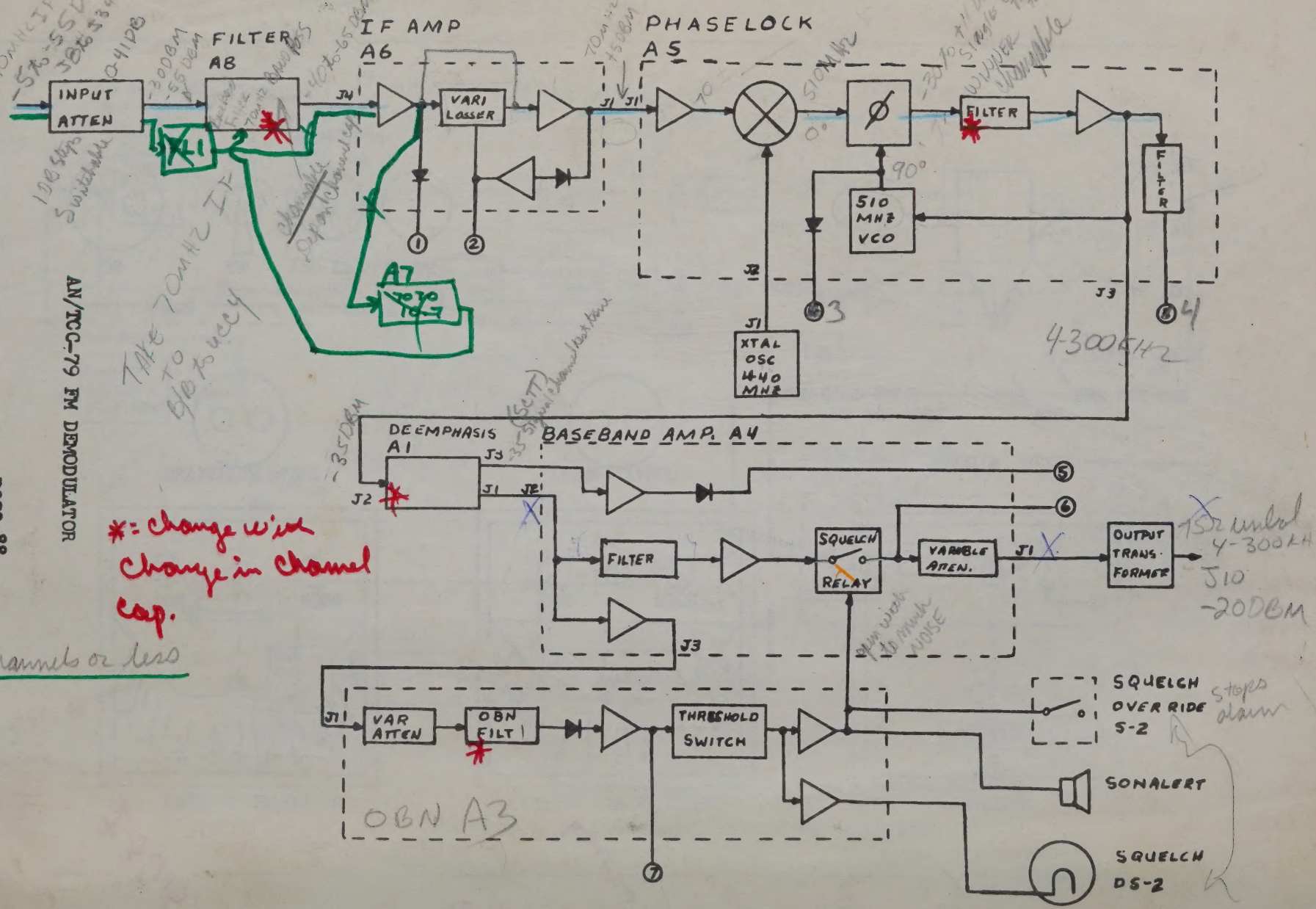


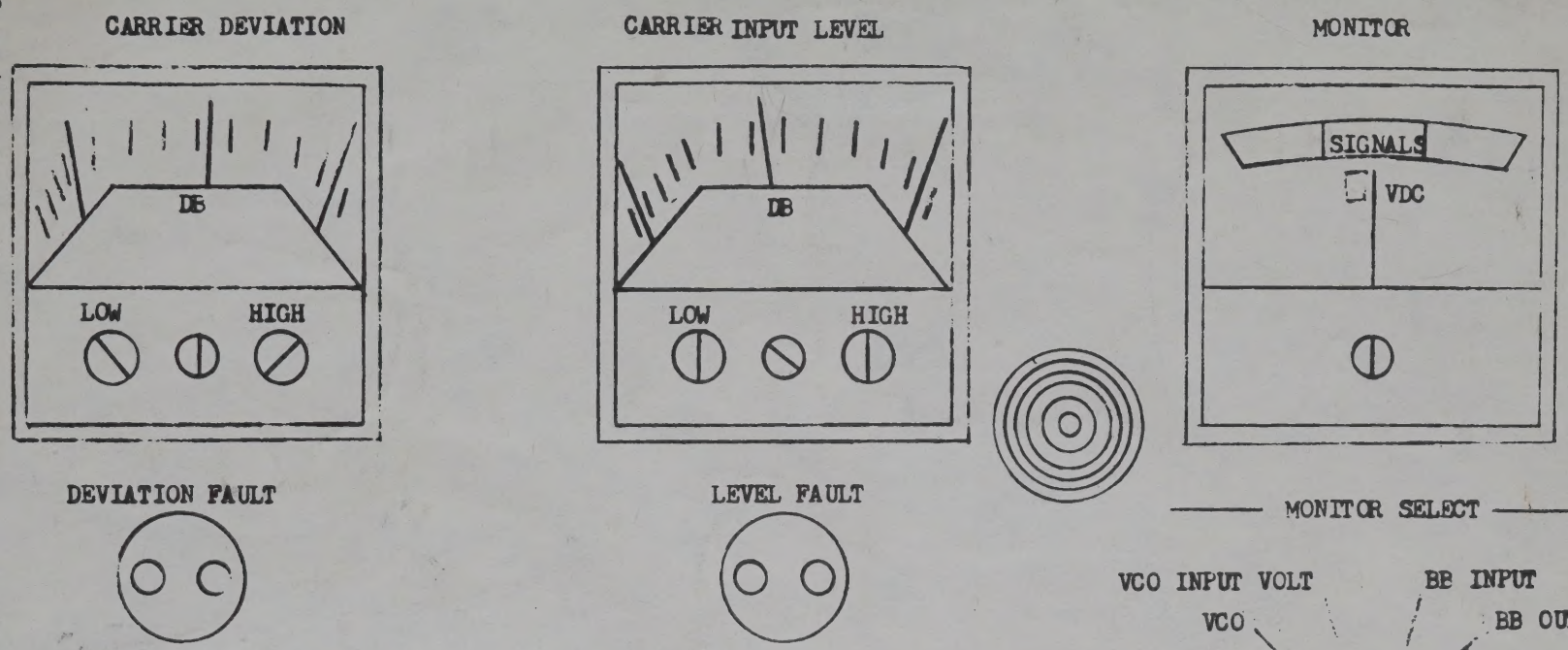






FM MODULATOR


INPUT ATTEN
FILTER A8
IF AMP A6
VARI LOSSER
PHASELOCK A5
FILTER
510 MHz VCO
XTAL OSC 440 MHz
DEEMPHASIS A1
BASEBAND AMP. A4
FILTER
SQUELCH RELAY
VARIABLE ATTEN.
OUTPUT TRANSFORMER
VAR ATTEN
OBN FILT
THRESHOLD SWITCH
OBN A3
SQUELCH OVER RIDE S-2
SONALERT
SQUELCH DS-2
*: Change w/in Change in Channel cap.
12 Channels or less



FM DEMODULATOR

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